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EXPANDING CONSCIOUSNESS AND DEMOCRACY[1]

By Professor H. W. SHIMER

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FROM the point of view of a student of evolution it would seem that much of the trouble in the world to-day results from the age-old conflict between two major impulses of life. These are the impulses of each individual organism to live its own life in unhampered freedom, and the impulse of each individual to seek association with its own group. Life tends to vary, to differentiate, to individualize, a tendency which is in continued conflict with the "herd instinct," the impulse of individual organisms to come together for protection and aggression.

Evolution implies that through the long history of life new types have come into existence through descent, with slight modifications, of new individuals from pre-existing individuals. Life would long ago have vanished from the earth in the face of the difficulties and dangers in its environment, had it not been for this overwhelming urge of each individual organism to live and to reproduce.

While, however, life was limited to one-celled and self-sufficient organisms, there could be little advance in evolution. Later single cells came together to form many-celled larger units, with their enlarged possibilities. In each of these the component cells divided the labor of preserving the larger organism, and hence the existence of each individual cell came to depend on the existence of the other cells. And it is possible that in these larger many-celled organisms may have arisen the first diffused beginnings of the impulses which are sometimes classified together as the herd instinct.

From such cooperative beginnings the evolutionist traces the long succession of increasingly compact groups up to their culmination in the swarm, the herd,

[1] Address of the retiring president of the Boston Geological Society.

the pack and, in man, the tribe and nation. An underlying principle in this evolution is that "in union there is strength," a greater probability of survival of the larger unit, whether the union be physical, instinctive or consciously social.

All such growth, however, of the "coming together" impulse brings about as a necessary corollary a *subordination* of the more personal interest of the individual. The later developed unity frequently asserts its interest at the expense of the interest of its components. An animal in a trap may gnaw off its leg, itself composed of myriads of cells, in order to save the larger unit. The non-working drones are killed by the workers in a hive. Offending individual man is put in prison. In such cases the individual self-preservation instinct must subordinate itself to the impulse to preserve the herd, the larger unit.

Thus, throughout this long course of evolution, may be seen the expansion of organic life, with its attendant first beginnings of consciousness, from the first single cells, with their ruling impulse to live as individuals, through the many-celled organisms, and on to the larger groups where the interest of the larger cells is at times completely dominant over that of the individuals.

In conjunction with the evolution of the instinct for self-preservation, there has taken place a progressive expansion of the reproductive impulse, especially into the parental instinct. The more lowly animals of the Paleozoic gave no care to their offspring after the eggs were laid. Such increased care for the next generation appeared with the advent of certain fish, insects and birds and the mammals of the Mesozoic, if we may judge from the behavior of the closest modern descendants of these groups. The parental instinct then enlarged its range of expression from the immediate offspring to other members of the herd. In more advanced man the love of children and neighbors begins to enter the more *outlying* fields of the weaker members of his species, the under-privileged and the less normal.

Thus as the student of evolution looks back over the series of living forms that have populated the earth for a billion years, he sees them controlled by impulses that foster both variation and protection, radicalism and conservatism. He may consider these instincts as expressing a gradual expansion of consciousness. During this evolution, consciousness, at first expressed simply as awareness, has expanded from the individuality of the single cell, through that of the many-celled individual, to the enlarged sense of the unity of the group composed of many multicellular organisms. The behavior of the higher organism depends on a series of impulses that becomes more and more complicated—the impulse to preserve its own life at all costs coming into conflict with its impulse to preserve and care for its young and with its impulse to enter into large groups for the aggressive and defensive benefits it receives from such association in the group. In the lower animals, as, for example, in insects, there is little conflict in the group because there is little individuality. But, in mammals, an increasingly sensitive nervous organization and progressively larger brains introduce the capability for more varying individual action.

Insects are encased in a completely enveloping external skeleton of chitin. This necessitates molting for growth and restricts the possible size of the organism. Moreover, chitin is easily modified into organs specialized to the needs of each species; only a small amount of intelligence is required to use these implements evolved for each particular use. Hence the reaction of each insect to any particular environment differs little from that of any other insect; it has specialized tools all ready to meet it.

In contradistinction to the insects, the vertebrates possess an internal skeleton, to the outside of which the muscles are attached. Vertebrates can thus grow without molting and can reach a much greater size and develop a much more complex nervous system. The internal skeleton is not in direct contact with the environment, nor is bone so easily modified or so capable of being fitted to such a variety of uses as is chitin. Not having been able, accordingly, to evolve a special instrument for each particular environment, vertebrates must modify the *use* of what they have; in other words, they must use their brains to solve each problem. They have thus developed intellect to supplement instinct, which is the sole resource of insects.

As has been seen, increased use of the brain results in a greater variation of action, in increased development of individuality. But when vertebrates began to band together for getting a better food supply and better protection of the young, they had to give up a certain amount of this individuality of action. The strong herd of herbivores may eat almost where and when it will, but the individual must secure its food in close competition with the other members of the herd. The carnivore pack can capture larger and fleeter animals than can each member of the pack alone, but they must compete with one another over the captured prey. Such aggregation of individuals into herds or packs is characteristic of the higher mammals, including the higher Primates, to which man belongs. A tribe can survive where a single family can not. An aggregate of tribes, or nations, has greater survival value than a single tribe; it tends to subordinate intertribal warfare to the competition with other nations. The next logical step would be the international Earth Nation which should tend toward

subordination of warfare between nations to the problems of cultural survival and improvement of all the peoples of the earth.

Consciousness, starting thus as the awareness of an organism to the individual problems of food supply and self-preservation, expands to the increased instinctive care of the young. Because of their internal skeleton, the vertebrates have found the need of increased use of the brain to solve their increasingly complex problems of survival. This increasingly larger brain in the higher mammals and the necessity for individual decision at frequent intervals result in the increasing emergence of a certain faculty of curiosity in the higher mammals. When the individual is somewhat released from its necessary concern with the getting of food and the avoidance of enemies, curiosity about the environment grows. This is well seen in cattle, horses and the mischievous monkeys. And, finally, the philosophic and scientific curiosity of man results in further accentuating the variations among individuals. Such variations are still in conflict with the ancient and powerful instincts for food, safety and family. Fears and hopes connected with these self-preservative instincts may be so increased by education or propaganda that for a time individual man may be willing to permit his thoughts and actions to move in only directed grooves. Yet even in such times of public fears and stresses and emotional urge, there always remain some individuals whose minds can not be kept along ordered grooves; they persist in seeing avenues to be explored along forbidden lines. Such men formed the majority of immigrants into new territory. They were the pioneer philosophers and scientists at times when it was dangerous to think along new lines. A nation may be kept in an unchanged condition only by banishing or killing these mentally restless individuals.

To recapitulate, when man comes to look back upon the way his animal ancestors have traveled, he finds in himself the field of conflict between ancient instincts. He must obey the impulse of self-preservation. He feels the urge to protect his young. He is impelled to join with others of his species for protective and offensive advantages. His tendency to variation as an individual must thus be at times subordinated to the interest of the group. In human affairs, as in geologic processes, centrifugal and centripetal tendencies must be in a state of constant readjustment.

Heraclitus of Ephesus, some twenty-five centuries ago, in his statement, "Panta rei," expressed the universal law of movement, that all things are being perpetually transformed into new shapes. The geologist sees the wearing away of solid rocks, the removal of the dissociated matter to lower levels, with the consequent lowering of mountains and filling in of basins. The final goal of such processes would be a featureless landscape. Such a final state of quiescence, such cessation of the labor of running water, has never been attained, for new lands are being raised and new mountains are formed. Our backward glance over many millions of years of earth history shows these opposing forces of change to have been constantly operative.

The biologist sees the gradual dissolution of the physical forms of organisms into the featureless goal of the physical elements, but throughout earth history this goal has never been attained for all animals at any one time. For death and dissolution of the old forms are always accompanied by the birth of new organisms and their struggle to maturity and old age.

Thus neither life nor the earth upon which it exists is static. There are always two opposing forces at work—one tending toward a featureless order or death, the other towards diversity, disorder.

This universal law of movement is operative in man's social organization in all its forms from the home to the nation. We see here, too, a constant struggle between diversity and featureless order. Man's large and active brain produced the printing press, which enabled man to make and preserve records of what his immediate forerunners have done, thus giving to each succeeding generation a fuller social inheritance and a closer contact with the present world. Such resulting reaction of mind on mind has brought about the extraordinary increase in diversity of modern life and its accompanying subdivision of labor, a diversity that inevitably produces inequalities in the social structure. This has naturally called forth a demand for a greater measure of order among many of these conflicting diversities. In the attempt to meet this demand we witness to-day experiments in various forms of autocracy and regimentation. In any such panacea, whatever tends to reduce diversity of thought weakens the long-time vitality of the group or nation that tries it; it is, by analogy with geological and biological processes, a step towards its final dissolution. In the words of A. G. Huntsman, the perfect goal in a social structure would seem to an evolutionist to be the welding of the fullest possible diversity into an orderly, harmonious whole. In the extent to which this problem is solved is shown the mental caliber of the social group.

The many forms of government in the modern nations may be classified according as they emphasize the dignity of the individual, that is, the contribution that varying thinking may give, with the resulting tendency toward diversity; or, on the other hand, as they emphasize the enhancement of the state or nation, with the consequent tendency toward stagnation and the ruthless subordination of the individual toward conformity with one fixed ideal.

To the student of evolution who looks back over the

history of the earth and its burden of living forms, who sees in both geologic and organic evolution the never-ending conflict between forces making toward diversity and forces making toward order and conformity, the ideal government would seem to be democracy. Life would be impossible in an anarchy, where each individual conducted his life in entire disregard of the needs of the larger group. Full creative life is equally impossible in a totalitarian government where all human activities must conform to a single central policy. In democracy alone, where freedom of thought is safeguarded and allowed expression in freedom of speech and of the press, and where, at the same time, freedom of action is, to the measure of the general good, controlled by the people themselves—in democracy alone may man evolve most freely. New thoughts can be tried out for their survival value in private schools and colleges, in cities and in states. It is these new ideas that constantly add to the richness of the nation and to the fullness of life of its citizens. Of course, in this very strength of democracy lies its weakness; this great and increasing diversity of life must be made sufficiently orderly to function and to protect the numerous minorities as well as the majority whose opinions dominate at the moment.

In the French Revolution the ideal was Liberty, Equality and Fraternity. At Gettysburg Lincoln reaffirmed that our nation was conceived in liberty and dedicated to the proposition that all men are created equal. These are the two eternally conflicting principles, liberty and equality. To make men and women equal in all things—houses, goods, education, length of working time—compulsion would be needed, an outside dictating authority. Some do not wish a college education, ideas of a desirable house differ. Some wish to carry business thoughts beyond the day into the night hours. To make all equal in all respects, regimentation would be required, and we would not have liberty. On the other hand, liberty for each to do as he wished all the time would interfere with the liberty of all the others, and hence there would result no equality. Yet the future of any nation depends upon these liberty-loving, mentally restless individuals. New application of well-known principles may be developed along directed grooves, but for the envisioning of new truths, the development of entirely new outlets for human energy, the individual must be free to think along any line and to try out these thoughts with his peers.

Democracy stands ideally for both liberty and equality with their unending conflict and unending readjustment. Democracy solves its issues by majority rule. At times this rule may be wrong, but experience and education can, through the pressure of a minority group acting on public opinion, bring about changes, because it is of the essence of democracy that smaller groups should, through freedom of speech and freedom of assemblage, have the opportunity to present their ideas before the groups that may at the time be dominant. It is a slow process, but the results are stable. Absolute truth in human affairs is not revealed to any one; it must be approximated through intellectual cooperation, and that means freedom of speech and of the press. It means a thorough appreciation of the dignity of the individual.

What definition of an ideal government could be more in conformity with the spirit of evolution than that given by Dorothy Thompson in her discussion of the meaning of democracy?

> Democracy for most of us is not an ism. It is a way of life. It does not represent any rigid form of state or national organization. It is something constantly developing and unfolding, changing from day to day, making mistakes, advancing in this direction and retreating in that, but always animated by a few fundamental ideas: that men have a right to live their own lives provided they don't tread too heavily on other people's toes; that the state is not endowed with any divine rights but is merely a useful instrument invented by men to serve them . . . that the individual shall be judged, not by his race, background or national origins, but by his human qualities of heart and mind and skill; that laws which every one must obey shall not be arbitrarily made but should be the result of debate, deliberation, consultation.

What better than democracy can aid the evolution of the life that for a million years on earth has been expressing itself in human form?

To briefly summarize: Through two billion years of evolution physical forms have been evolving. During the comparatively recent years of this evolution the human body has come into being, with its burden of animal appetites and instincts, with, in addition, its tool-making hand and its larger brain and nerve mechanism for conscious thought.

This animal, awaking into self-consciousness as man, finds that his life is the product of two sets of forces, first, forces outside himself, his environment inorganic and social, and second, forces within himself, the bundle of forces with which he is born, that constitute himself—the *body* with its appetites and needs and governed by a set of instincts, all inherited from a long line of animal ancestry, and that which takes *cognizance* of all this and knows that it is in control. Man wakes to find himself whirled through life, drawn by his appetites and emotions, but because he is man, the thinker, he realizes that it can be increasingly in his power to control these appetites and to some degree control the activities of his life.

He sees around him other thinking individuals, with the same instincts and emotions, linked with him in

family, community, state and nation, each striving to live a full and safe, that is, a happy life. He sees other groups of individuals forming other nations of which the individuals also wish to lead happy lives. He shares with all the inheritance that accompanies the physical body, as, for example, such emotions as intolerance and belief in force; he finds that all are subject to the passions of the pack, as seen in mob violence and in heresy hunting spasms. Accompanying these impulses, he sees also emotions of a kindlier nature, sympathy, forbearance, protection of the weak, all growing out of the parental instinct. These, however, were evolved later in time than the preceding ones and are at times submerged by the older and hence stronger emotions.

In some nations he sees where certain groups have made use of force and intolerance to become supreme, with at times a single man becoming dominant over the thought and actions of a nation. In other nations he sees a frequent shifting of government, as one group after another succeeds in seizing control by armed force. And finally, he sees the nations in which control of any group is decided by majority vote.

As man views such democracies, he realizes that they are succeeding only because education is required of all, and because there is freedom through press and discussion for the expression of varying views. It is this accessibility to varying views and to consequent possible change that gives the democratic form of government the vitality of an evolving organism. Here may humanity find freedom for expansion in the limitless realm of the human spirit, new thoughts ever leading into new activities and a continually richer life. Expansion of consciousness in man can result only from such never-ending compromise between liberty for each and equality for all.

"HOW SOON WILL THE 'MANUAL' BE DONE?"[1]

A PLEA FOR SOME UNDISTURBED MOMENTS

By Professor MERRITT L. FERNALD

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IN 1829, in edition 5 of his "Manual of Botany," Amos Eaton wrote: "Many vain botanists are continually in search of new species; and their vanity leads them into gross absurdities. . . . There is not [note the singular verb], probably, 50 undescribed species of Phenogamous plants in the United States—perhaps not one species east of the Mississippi." Amos Eaton believed in a simple system of classification, which still prevails in some centers, arranging his genera (without designation of families and orders) in strictly alphabetical sequence. In 1873, William H. Leggett, then editor of the *Bulletin of the Torrey Botanical Club*, wrote in volume iv (19, 20): "Many causes have led botanists in America to give their attention more particularly to the systematic part of the science; but this field has been so well worked, and is so full of workers, that there is little room for any new comer to add much to our knowledge."

Amos Eaton closed the door on further discovery of plants in the United States 109 years ago; Leggett again shut it 65 years ago. Nevertheless, here we are assembled as the American Society of Plant Taxonomists. In the southern idiom: "Wha' for are we all here?" Can it be that we are here simply because we are hungry?

I find myself retiring president of one of the least organized organizations in the country. When I was told that you had elected me your president, I was specially instructed that I must be wholly passive and "let George do it"; I was merely an ornament to be displayed at dinner after you had all presumably overeaten and were not too wide awake. In other words, the president of this organization without organization becomes the retiring president upon election. Retiring, according to the dictionary, means going out of sight or notice; shrinking from publicity; subdued.

There are advantages to these conditions. For instance, when the botanists planned to meet in Ottawa last summer I tried to make it clear that I could not be there, that my obligations in Cambridge and the special field-work I had undertaken in Virginia would make it out of the question. In the old days if one wished to become invisible it was necessary to go out in the moonlight on St. John's eve, and, while reciting the Pater Noster backward, to gather either the seeds of St. John's wort or "fern seeds." But now the process is more subtle. One needs to become a retiring president. At the time of the Ottawa meeting I was either in Cambridge or in Virginia (I haven't verified the dates). But as a retiring president (or one who shrinks from sight) I seem to have been present, though invisible, at Ottawa. I didn't know it myself; but the official report which I read in SCIENCE definitely stated that I was there and that I presided at one of the sessions.

But to come to the main theme. My text this eve-

[1] Address of the retiring president of the American Society of Plant Taxonomists, Richmond, Va., December 28, 1938.

ning will be found in the closing sentences of 999 out of every 1,000 letters which reach me:

"HOW SOON WILL THE 'MANUAL' BE DONE?"[2]

Fully appreciating the interest of all of you in this vital topic, I am going to show you as briefly as possible why the conscientious writing of a manual is a slow and exacting task. It would be quite possible to hire an inexperienced clerk without too much knowledge of plants and to have him compile from the manuals of others a book which would look like Gray's "Manual." I realize that that is an up-to-date method of doing research and that some people applaud books thus produced; but I am old-fashioned and that is not my idea of a wholly satisfactory method of work. Conceptions of generic and specific lines vary. My own do not always coincide with those of some others; and the book I am trying to produce must be based upon my own studies and deductions. The period since Robinson and I transposed into the metric system the measurements in the sixth edition, shifted the nomenclature to meet the then current international rules, and revised the treatments of such groups as had already been revised, has been one of tremendous activity. The ghosts of Amos Eaton and of William H. Leggett would shrink into mere shades if they realized what has been going on. In my office there are card-catalogues of current items regarding range-extensions, nomenclature, technical characters, new discoveries and differences of opinion. Computing from the contents of one drawer, I estimate that these trouble-making card-catalogues contain 150,000 entries. Figuring that one half of these record differences of opinion, you can see what I am facing. The reconciling of 75,000 differences of opinion and the drawing from them of something resembling my own ideas is really some task! If one of the entries gets overlooked the whole book will be condemned. Nevertheless, working in those abundant moments of a teacher with a full quota of lectures; with a dozen or more tremendously diligent and earnest research students finding puzzles to be solved; with the monthly editing of a technical journal, most of whose authors want their data and statements verified by the editors; with a mail of 20 or more letters a day, each asking or claiming the individual judgment of the recipient on some question he knows nothing about (and some of the letters as appealing as the following: "Professor Gray Hibernian, Curate of the Garden, Boston. Dear Professor Hibernian: Our class has a project on the flowers of Massachusetts. Please send us on the inclosed sheet all you know about the above subject and oblige"); with daily packages of all the miscellaneous puzzles which have been given up in local herbaria over the United States and Canada; with semi-weekly second or third appeals for a brand new autobiography to be published in the indispensable "Who's Who in Ward 7" or in "The Lesser Men of Science"; with six-page questionnaires on every conceivable subject; with requests from *Chronica Botanica* for a list of every one of the thousands upon thousands of collectors represented in the Gray Herbarium with a biographical sketch of each one; all these in addition to the regular extra-classroom duties of a university professor and the director of an active research establishment—in this plethora of free time the treatment of 756 genera, containing 3,300 species and varieties, has already been completed; and the genera contain such nice little groups as *Panicum* and *Solidago*. This may seem like slow progress to those who believe that I should crib my treatment of *Astragalus* from Rydberg and of *Solidago* from Mackenzie. My treatments of these groups, however, are based on my own studies; I could not honestly accept the other treatments, *in toto*, as my own.

Unhappily, or perhaps happily, as soon as news leaks out (and it always leaks out, especially if it is groundless) that I have finally written up some group for the "Manual," large packages and freight-boxes begin to arrive, with the kindly and very complimentary request that I stop all other work and spend three weeks studying and labeling all material of *Solidago* or of *Xanthium* and then return it to the sender; the accompanying letter of transmittal always ending: "How soon will the Manual be done?" Every one who knows me will tell you that I have a one-track mind, of course with the network of usual side-tracks at all stations of one-track roads. Incidentally my memory for forgotten details is not perfect. As a typical Cape Codder once remarked to me: "I have a good memory; only it is terribly short." If I yield to my sympathetic impulses and hunt up the revisions of groups long forgotten, in order to be accommodating, progress along the main line is stopped. I wrote up *Panicum* with its 110 species and varieties in 1934, *Antennaria* with 42 and *Solidago* with 120 in 1935, the *Ranunculaceae* with 175 in 1936. Those stations were long since passed and all the freight then assembled in them taken aboard. If, when I am struggling in interrupted moments to classify for proper delivery in 1939 the confused freight at Dogwood and Willowgrove stations, I am pressed to back up to the side-track at Goldenrod Crossing, which was safely passed in 1935 and where no new freight has been delivered, I shall not get back on the single main track and reach Hawkweed station, at the end of the line, in time to deliver the freight there. You might suppose that a man who is approaching the age of second childhood would remember everything in the distant past; but, frankly, when my mind is closely absorbed in trying

[2] Eighth edition of Gray, "Manual of Botany."

to untangle the intricately confused species of *Vitis* and endeavoring to discover really stable differential points, so that I can safely pass Grapevine Bower, or when I am trying to keep on the single track through the perpetually retarding thicket or brambles, my mind has become wholly blank regarding the finer details of *Rhynchospora* and of *Erigeron,* whose freights were long-ago checked off as safely on board.

Another of the perpetual obstacles to rapid progress along the line is the confusing and slipshod rubbish which clutters the track. One illustration will show what I mean. In 1890 a lifelong student of pondweeds, aiming to name a specimen from Spallumacheen River, British Columbia, called it *Potamogeton pusillus,* "var. *elongatus,*" giving little if any diagnosis. One year later, in 1891, he definitely described the British Columbian plant as var. *elongatus.* Ten years after it was cited formally by him as the type and only material of var. *elongatus* the Spallumacheen River plant figured, in 1901, as part of a second of the same author's varieties: "*P. pusillus,* var. nov. *capitatus.* This was sent me by Professer Macoun from Sable Island [Nova Scotia], and I have also specimens from the Spallumacheen River, British Columbia, which I had wrongly referred to my var. *elongatus.*" Just why "wrongly" does not appear, since the British Columbian plant was the type and only cited specimen of var. *elongatus.* The Sable Island plant is actually ordinary *P. pusillus,* var. *tenuissimus* Mert. and Koch., such as abounds in Canada and Eurasia.

In describing var. *capitatus* from Sable Island, its author said: "the fruit stems [whatever they may be] approach in character those of my *Potamogeton Aschersonii*" of Chile, thus starting further complications for the Sable Island plant. Var. *capitatus* had been given the highly impressionistic characterization "the heads of flowers at a short distance looking as though they are elevated above the plant without any peduncle." This is almost as definite as the same author's characterization of his *P. Sturrockii:* "Whole plant delicate, pellucid and not conforming to any named *pusillus,* but standing apart"!

Returning to *Potamogeton Aschersonii,* to which the Sable Island plant was said to be similar, *P. Aschersonii* from South America had a most extraordinary christening in 1893, said by the same English author to be a *pusilloid* species (*i.e.,* with narrowly linear leaves 0.1–5 mm broad); but its author said that its "linear" leaves were "1–3 in. long, 1–1½ inches broad. . . . Fruit 2¼ lines long, by 1½ inches broad." Obviously no plant with leaves 1–1½ inches broad belongs in the *Pusilli* (with leaves only 0.1–5 mm broad) and the fruits, described as being as broad as walnuts, are quite impossible in any pondweed. But when he suggested that the Sable Island plant, actually with leaves 1 mm wide and fruits 2 mm broad, belonged to the same group as *P. Aschersonii,* he started something. In 1916 a Swedish student of the group fell into the trap and definitely cited *P. Aschersonii* not only from South America, where it occurs, but from Sable Island as well.

Not only did the Swede so identify the Sable Island plant, the type of *Potamogeton pusillus,* var. *capitatus,* which was said by its own author to include his earlier-published var. *elongatus,* but it was also cited by the author of *P. Sturrockii* as that plant, the species which differs by "standing apart." To add to the dilemma we are seriously told that "Of a hybrid origin are, no doubt, the vars. *capitatus* . . . and *Sturrockii.*" This is almost the last straw (the last straw will blow across our horizon later). Little *Potamogeton pusillus,* var. *tenuissimus,* of Sable Island is not only that variety, but it is said likewise to be *P. Sturrockii, P. Aschersonii* and *P. pusillus,* vars. *capitatus* and *elongatus* and it is also "no doubt" two different hybrids. As the only representative of the group known to occur on Sable Island it has accomplished wonders. At least ten times in as many years I puzzled over the complex situation above described (with further complications introduced by Graebner) and, after intensive study for days at a time, repeatedly abandoned the maze, lest I should reach the mental condition aptly described in 1847 by Asa Gray in a letter to Jane Loring, his prospective wife, who to two generations of students was affectionately known as Lady Jane Gray. Here is Gray's letter:

> I have been addling my brain and straining my eyes over a set of ignoble Pond-weeds (alias Potamogeton) trying to find the
>
> "difference there should be
> 'Twixt tweedle-dum and tweedle-dee"
>
> and wasting about as much brain in the operation as your dear paternal would expend in an intricate law case, for all of which I suppose nobody will thank me and I shall get no fee. . . . But I shall be glad when they are done.
>
> 10: 45 P.M. There, the Pond-weeds are done.

Now for the last straw. The meddlesome young botanists at the British Museum have just brought forward the assertion that the one and only specimen before Linnaeus in originally describing *Potamogeton pusillus* has never before been critically examined by a student of the group, although the famous English student of the genus above quoted had always lived within an hour's ride of it. It is not at all what every one calls *P. pusillus* but another species. Now we must start all over again! Yet some people argue that botany is an exact science; furthermore, they repeatedly ask, "How soon will the 'Manual' be done?"

Potamogeton pusillus is not the only plant of our

flora of which the actual type, with which Linnaeus, Lamarck or Michaux worked, has been neglected. There are hundreds and hundreds of others. In that happy period when weight of authority and established usage were the law the old and historic specimens were of natural interest but not too binding upon the student. Now, with emphasis upon the historic type (beginning with 1753) and strict priority of publication the whole picture has changed. It becomes imperative that the groundwork of all our species be reinspected. This is slow and exacting work and too often there is difficulty in determining beyond dispute just which of several different elements should stand as the actual type. With the addition of these newly imposed burdens, the author of a manual which aims to be authoritative must be allowed some time in which to prosecute his exacting studies. If these unescapable studies are constantly retarded by the thoughtless and needless urging upon the author of too many axes to grind for others the question must inevitably arise: Which do eastern American botanists want done first, the "Manual" or its author?

OBITUARY

WILTON EVERETT BRITTON

1868–1939

A STERLING gentleman and an able scientist passed from life on February 15, 1939, with the death of Wilton Everett Britton, state entomologist of Connecticut and director of the State Geological and Natural History Survey. Few entomologists have had a more fully rounded career, and few have given so full a measure of unselfish service to their fellow workers and to the public.

Dr. Britton was the builder of the department of entomology of the Connecticut Agricultural Experiment Station. He lived to see his department housed in a building designed for biological research, and he gathered about him a staff of earnest and able men to carry on his traditions of quiet and thorough work. He took part in a score of activities relating to his scientific duties, and he exerted a wide and healthful influence.

Dr. Britton was born at Marlboro, Mass., on September 18, 1868. His early background, however, was rural, and his early years were spent on a farm in New Hampshire, near the city of Keene. In 1893 he received the degree of bachelor of science from the New Hampshire College of Agriculture and the Mechanic Arts, now the University of New Hampshire. In 1894 he was a graduate student at Cornell University. That same year he became a member of the staff of the Connecticut Agricultural Experiment Station, as horticulturist, and he continued as a servant of the state of Connecticut until his death. In 1901 he became state entomologist and entomologist of the experiment station. In 1925 he assumed the additional duties of director of the State Geological and Natural History Survey. On April 30, 1895, Dr. Britton was married to Bertha Madeline Perkins, of Surry, N. H. There were no children. In 1938, after a long illness, Mrs. Britton died. Two brothers and a sister of Dr. Britton survive him.

Two years after Dr. Britton became state entomologist of Connecticut he was granted the degree of doctor of philosophy by Yale University. Twenty-seven years later, in 1930, the University of New Hampshire conferred upon him the honorary degree of doctor of science.

The breadth of Dr. Britton's interest and activities relating to his profession is well evidenced by the memberships that he held in various organizations and the responsibilities that he discharged. Early in his work he became a member of the American Association of Economic Entomology, and he was elected president in 1909. He was associate editor of the *Journal of Economic Entomology* from 1910 to 1929. He assisted in preparing the indexes of *American Economic Entomology* covering the years 1905 to 1934. He was a fellow of the Entomological Society of America. For thirty-five years he was a member of the American Association for the Advancement of Science, and for thirty-three of those years he was a fellow. He was one of the organizers of the Eastern Plant Board and was president in 1936.

He was actively identified with the work of the Crop Protection Institute and for a period was a member of its board of governors. From its beginnings he was chairman of the Connecticut Tree Protection Examining Board. He was a member of the National Malaria Committee. His activities with various Connecticut associations included the Pomological Society, the Beekeepers Association, the Forest and Park Association, the Botanical Society, the Nurserymen's Association and the Vegetable Growers' Association.

Dr. Britton was deeply interested in books and their significance. He was a member of the Library Association of Connecticut, was director and president of the Donald G. Mitchell Library and for seven years was director of the New Haven Public Library. For twenty-seven years he was a director of the Young Men's Institute Library.

The breadth of his service is further indicated by the fact that he was twice president of the Edgewood Civic Association, was a member of the Governor's Foot Guard for three years, was a member of the

Grange for forty years, and was chairman of the Committee on Food of the New Haven War Bureau during the world war.

Dr. Britton began his professional work at a time when difficult insect problems were arising. Early in his career the San José scale was discovered in Connecticut. The gipsy moth presented further problems, both administrative and technical. It was followed by the Japanese beetle, the European corn-borer and the Oriental beetle. In addition came the task of organizing and administering mosquito control.

A long list of publications attest Dr. Britton's tireless professional activities. Outstanding among these are his thirty-eight annual reports on the insects of Connecticut, a comprehensive series of publications which are continually referred to by entomologists everywhere. Bulletins from his department of the experiment station include among others a plant pest handbook. Publications of the State Geological and Natural History Survey also are noteworthy, including a check list of the insects of Connecticut, a guide to the insects of Connecticut and monographs of the Euplexoptera and Orthoptera, the Hymenoptera, the Hemiptera and the Odonata. At the time of his death a monograph of the Diptera of Connecticut was being prepared. In addition to these various reports and bulletins, Dr. Britton was the author of many articles in farm papers and magazines.

Most of all, Dr. Britton was a helpful co-worker among entomologists, giving freely of his energies and always contributing the orderly judgment which was a part of his fine mental equipment. His service to his state was signally recognized on July 30, 1936, at the Farm and Home Week, when he was especially honored as a leader in agricultural and rural life.

W. C. O'KANE

UNIVERSITY OF NEW HAMPSHIRE

RECENT DEATHS AND MEMORIALS

DR. CHARLES RUPERT STOCKARD, professor of anatomy and head of the department at the Cornell University Medical College, died on April 7 at the age of sixty years.

DR. WILLIAM HALLOCK PARK, Hermann M. Biggs professor of preventive medicine at the New York University Medical School, formerly director of the Bureau of Laboratories of the Health Department of New York City, died suddenly on April 6 at the age of seventy-five years.

DR. JAMES CLIFTON EDGAR, emeritus professor of obstetrics at the Cornell University Medical College, died on April 7. He was in his eightieth year.

DR. WILLIAM C. THRO, from 1918 to 1937 professor of clinical pathology at the Cornell University Medical College, died on April 6. He was sixty-four years old.

DR. THOMAS S. BAKER, from 1922 to 1935, when he retired with the title emeritus, president of the Carnegie Institute of Technology, died on April 7 at the age of sixty-eight years.

ON the occasion of the celebration of the hundredth anniversary of the birth of Théodule Ribot, who played an important part in France in the establishment of a scientific psychology, a commemorative ceremony will be held in Paris in June. There will also be celebrated the fiftieth anniversary of the establishment of the chair in experimental psychology in the Collège de France, which was first held by Th. Ribot and later by Pierre Janet, and of the laboratory of physiological psychology at the Sorbonne, of which Dr. Alfred Binet was director.

SCIENTIFIC EVENTS

PATENT INQUIRY OF THE AMERICAN ENGINEERING COUNCIL

THE Executive Committee of the American Engineering Council at its meeting on December 8 accepted the invitation of the National Industrial Conference Board to undertake a factual inquiry into the American Patent System. The inquiry is to be conducted by a separate special staff employed under direction of the Patents Committee of the American Engineering Council. The inquiry is to be financed from funds outside the present income of American Engineering Council, which are being provided by the National Industrial Conference Board.

The announcement of the plan was made by the National Industrial Conference Board in the following statement:

A comprehensive investigation of the whole patent problem has just been started by the National Industrial Conference Board, independent fact-finding organization of management and labor. Technical phases of the investigation will be supervised by the Committee on Patents of the American Engineering Council, while the economic aspects will be analyzed by the conference board's economists under supervision of Dr. Robert F. Martin, director of the Economic Research Division of the board. Much work on the patent situation has already been done by the American Engineering Council Committee under the chairmanship of R. S. McBride, consulting chemical engineer. The other members of the committee are James

H. Critchett, general manager, Union Carbide and Carbon Research Laboratories, Inc.; William M. Grosvenor, consulting chemist and factory engineer; Frank B. Jewett, president, Bell Telephone Laboratories; Warner Seely, secretary, Warner and Swasey Company, and Kenneth H. Condit, executive assistant to the president, National Industrial Conference Board. Close cooperation with other organizations concerned with this problem is assured through representation on their patent committees by members of the board's staff.

Every phase of the patent problem will be studied by the experts of the Conference Board and Engineering Council. Five main headings are included in the outline of the inquiry. Under the general topic "Invention," there will be a study of the origins of inventions and a review of independent and organized invention. Such matters as costs, types of invention, work on inventions, use of patents and foreign experience will also be covered.

Perhaps the most important subject of the five concerns the social and economic effects of invention. Under this heading the effects on consumers, labor, capital and management will be studied in detail.

A third heading covers an examination of the patent system itself and the functioning of the Patent Office. Consequences of the patent system as shown by stimulation of invention and discovery are covered in another section. The final heading includes a critical review of the functioning of the patent system and of current criticisms and proposed reform.

This cooperative undertaking makes possible the fulfillment of recommendations made for such a fact-finding study earlier presented by the Patents Committee of the American Engineering Council to the Annual Assembly in 1937 and 1938, and approved by that body. The Patents Committee, at a meeting held in New York on December 9, approved of a detailed plan of procedure, and one division of the work has already been started. It is hoped that the complete undertaking will be finished within twelve months and that factual sections of the inquiry can be released before that time.

THE BRITISH JOURNAL OF ENDOCRINOLOGY

THE British Medical Research Council has issued a statement calling attention to the fact that the large and rapidly increasing amount of published work on endocrinology by British investigators has, for some time past, made it desirable to bring together and to make available in a single British journal papers which are at present scattered among many different publications. It is pointed out that, though there may be doubts as to the desirability of any step which might seem to accentuate the division of the field of the medical and biological sciences into specialized departments and groups, the lack of a British journal specifically devoted to endocrinology leads to the overloading of journals having other and more general interests, and is producing a position of increasing difficulty for those who have work on endocrinology to publish, as well as for those who need ready access to the published work in this field. The editorial boards of a large number of British journals have been asked for their views on the matter and are, without exception, favorable to the foundation of such a journal.

A committee has therefore been formed for the promotion of a new journal to be called the *Journal of Endocrinology*, in the first instance to be published quarterly. The members of this promoting committee, who will act as a committee of management, are: Dr. P. M. F. Bishop, Professor F. A. E. Crew, Sir Henry Dale, Professor E. C. Dodds, Professor C. R. Harington, Professor G. F. Marrian, Dr. F. H. A. Marshall, Dr. A. S. Parkes, Dr. F. G. Young and Dr. S. Zuckerman. They have appointed Professor E. C. Dodds as editor, to be assisted by an editorial board consisting of Dr. P. M. F. Bishop, Professor C. R. Harington, Dr. A. S. Parkes, Dr. F. G. Young and Dr. S. Zuckerman. Dr. R. L. Noble has been appointed assistant editor.

The scope of the *Journal of Endocrinology* is defined as the publication of communications which advance knowledge concerning the internally secreting glands, the mode of their actions, the nature of their secretions and the disorders of their functions.

TOUR OF THE INDUSTRIAL RESEARCH INSTITUTE

A TOUR of industrial research laboratories for members and guests of the Industrial Research Institute will precede a two-day convocation in the building of the National Academy of Sciences in Washington, has been announced by Maurice Holland, executive officer for the institute.

The institute, an affiliate of the National Research Council, will begin its visit to industrial laboratories on Tuesday, May 16, and will conclude the trip with a luncheon at the Hotel Mayflower in Washington on Saturday, May 20.

The group will assemble on Tuesday, May 16, at Canton, Ohio, where the first visit of the four-day trip will be at the laboratories of the Hoover Company. H. Earl Hoover, vice-president of the Hoover Company, is vice-chairman of the institute. From Canton the party will proceed to Pittsburgh, where they will make an all-day inspection of the laboratories and plant of the Jones and Laughlin Steel Corporation. The host there will be H. W. Graham, chairman of the executive committee of the institute, and chief metallurgist for the Jones and Laughlin Steel Corporation. The value of research in the steel industry is being determined by practical results in the pilot plant research and development laboratories at the Jones and

Laughlin Steel Corporation, which the visitors will view.

On May 18 the party will visit the laboratories of the Hercules Powder Company, at Wilmington, Del., where O. A. Pickett, director of the Experiment Station, will personally direct the tour of inspection.

The party will reach Washington on Thursday night, May 18, remaining there on Friday and Saturday, May 19 and 20. The two-day technical meeting of the institute will be held in the building of the National Academy of Sciences, where the members will be welcomed by Dr. Albert L. Barrows, executive secretary of the National Research Council.

The American Express Company is in charge of travel arrangements for the laboratories tour.

The membership of the institute is made up of executives in charge of research laboratories for small and large industries in the United States. It was formed a year ago "for cooperative study of the members' common problems of research management, for mutual criticism, exchange of ideas in an effort to bring about constant improvement of laboratory management."

AWARDS OF THE LALOR FOUNDATION

THE Board of Trustees of the Lalor Foundation has announced five awards for research in chemistry for the academic year 1939–40. These awards, which are for $2,500 each, are designed to enable men of outstanding ability to carry on special investigations at research centers of international importance. The recipients of the awards were chosen from a group of fifty-one candidates representing applicants working in the major fields of chemistry and related sciences.

The applications received indicate a wide-spread interest in these awards, 40 per cent. having come from candidates from universities in the eastern United States, 30 per cent. from the Middle West, 5 per cent. from the South, 15 per cent. from the Far West and 10 per cent. from candidates outside the boundaries of the United States.

As respects institutions where applicants elected to carry on their research, 50 per cent. selected eastern universities, 10 per cent. middle western institutions, 7 per cent. the Far West, 25 per cent. chose English universities, none selected Germany and 8 per cent. selected other European continental institutions.

The recipients of the awards are:

DR. OTTO KARL BEHRENS, of the Rockefeller Institute of New York, to work with Dr. D. Keilin, of the Institute of Biochemistry, Cambridge, England, on the chemistry of peptide metabolism in tissue slices.

DR. ANDREW CALVIN BRATTON, instructor in pharmacology at the Johns Hopkins University Medical School, to continue work with Dr. E. K. Marshall on chemical aspects of chemotherapy of compounds of the sulfanilamide type.

DR. ROBERT BYRON JACOBS, of the Research Laboratory of Physical Chemistry of the Massachusetts Institute of Technology, to continue work with Dr. F. G. Keyes on the fundamental properties of materials at low temperatures.

DR. WILLIAM EARL ROSEVEARE, assistant professor at the University of Wisconsin, to work with Dr. Henry Eyring at Princeton University on the determination of intermolecular forces in binary gaseous mixtures.

DR. CHARLES E. WARING, assistant professor at the Brooklyn Polytechnic Institute, to work with Dr. C. N. Hinshelwood at the University of Oxford on the kinetics of decomposition of silicon alkyl compounds.

The selection committee acting for the foundation consisted of Dr. Roger Adams, director of the Department of Chemistry of the University of Illinois; Dr. Hans T. Clarke, professor of biochemistry, Columbia University; Dr. Charles A. Kraus, of Brown University, president of the American Chemical Society; Dr. Arthur B. Lamb, director of the Division of Chemistry of Harvard University, and C. L. Burdick, secretary of the Lalor Foundation.

CELEBRATION OF THE SIXTIETH BIRTHDAY OF ALBERT EINSTEIN

THE sixtieth birthday of Albert Einstein, which occurred on March 16, was marked by a special radio program from Oakland, Calif., in which Professor J. Robert Oppenheimer spoke as follows:

This program is in celebration of the sixtieth birthday of Albert Einstein. His name is perhaps more widely known than that of any other living scientist; and to many millions of people it has come to stand for science itself, and for all that we admire in the way of life and thought of the scientist.

Most of us who are concerned with research in one or another branch of scientific work, are proud to have in Einstein a popular symbol of what we are doing and trying to do. Few men have contributed so much to our understanding of the Physical World, to our ability to predict and follow and control its behavior. And we see in Einstein, especially those of us who have come to know him a little, all those personal qualities that are the counterpart of great work: selflessness, humor, and a deep kindness.

But if few scientific workers would quarrel with the fact that Einstein is in many ways a perfect symbol of their work, there are many who would feel that there is something a little false and fabulous in the way he is thought of. There was a fable at one time that there were only a dozen men who could understand what Einstein had done; there is certainly a general impression, supported in part by his eminence, that his work has been qualitatively different from that of his fellow workers; that it is abstruse, and remote, and useless. This

seems to me a very strange ground for admiration. And of course it is not true; and the truth is much better than the fable.

All discoveries in science grow from the work, patient and brilliant, of many workers. They would not be possible without this collaboration; they would not be possible without the constant technological developments that are necessary to new experiment and new scientific experience. One may even doubt whether in the end they can be possible except in a world which encourages scientific work, and treasures the knowledge and power which are its fruits.

For science is not parasitic on society: it makes a good return. And it is for its return, and not its abstruseness, that our children, when they learn of Einstein's work in college or in school, will prize it. It will be part of their thought, as for us to-day the work of Newton and of Pasteur; they will be able to trace its history in the development of countless new and powerful technological methods. In fact it was some of the early work of Einstein on the theory of relativity that first pointed the way to vast and hitherto untapped sources of energy. We know now that most of the sun's heat comes from these sources. And it is one of the most spectacular projects of contemporary atomic physics to make this energy available terrestrially, and thus to solve as far as human wants are concerned the problem of mechanical and electrical power. One could multiply instances of the usefulness, in the most direct and immediate sense, of Einstein's discoveries. But in every case we would find their development so closely interwoven with the work of countless other scientists and technicians that there would seem something artificial to such an analysis, and we would come away with only a deepened conviction of the cooperative and interrelated character of scientific achievement. And if we were to trace the effects of any great scientific discovery on human thought and culture, we should find a similar story.

It seems appropriate, on Einstein's sixtieth birthday, to speak of these simple things with a certain seriousness, for we know that he himself has been led to question the possibility of continued scientific progress in a world dominated by fascism and by fascist thought. We may be sure that it is not the special persecution to which he has been subject which has raised these grave doubts. It is a deeper thing. For it would seem that in a fascist world neither the technological nor the cultural fruits of science could find anything but abuse. For technology, by rendering less desperate the struggle for an adequate and rich existence, should tend to reduce and not increase the exploitation of man by man and of nation by nation. And in general the effect of science is to reduce too the absoluteness of the differences between people, and to increase their common understanding: that is just the content of its objectivity.

There are surely graver reasons for concern in the contemporary world than this threat to the future of science. But I doubt whether to-day there can be any better way to honor Einstein than to commit ourselves to the kind of world in which such work as his can be possible.

SCIENTIFIC NOTES AND NEWS

DR. SAMUEL C. LIND, dean of the Institute of Technology of the University of Minnesota, previously director of the School of Chemistry, has been chosen president-elect of the American Chemical Society.

A MEETING of the Harvey Cushing Society in honor of the seventieth birthday, on April 8, of Dr. Harvey Cushing, Sterling professor of neurology emeritus at Yale University, was held in New Haven on April 7. The speakers included Dr. Walter Freeman, professor of neuropathology at the George Washington University; Dr. James W. Watts, of the department of neurosurgery at the Hospital of the University of Pennsylvania, and Dr. Tracy J. Putnam, professor of neurology at the Harvard Medical School.

MERRITT L. FERNALD, Fisher professor of natural history and director of the Gray Herbarium of Harvard University, has been elected an honorary member of the Nova Scotian Institute of Science in recognition of his work on the flora of the Maritime Provinces.

AT the annual meeting of the Philadelphia College of Pharmacy and Science held on March 27, Dr. Wilmer Krusen, formerly director of public health of Philadelphia, was reelected president for the thirteenth time.

PROFESSOR FRANK E. RICHART, professor of engineering materials at the University of Illinois, was elected president of the American Concrete Institute at the recent annual meeting in New York City.

Nature states that at the annual general meeting of the Ray Society, London, held on March 23, the following officers were reelected: ***President,*** Sir Sidney F. Harmer; ***Treasurer,*** Professor F. E. Weiss; ***Secretary,*** Dr. W. T. Calman. Dr. John Ramsbottom was elected a vice-president.

DR. FRANKLYN BLISS SNYDER, professor of English, vice-president and dean of faculties of Northwestern University, has been elected eleventh president of the institution. Dr. Snyder, who has been associated with the university for thirty years, will succeed Dr. Walter Dill Scott, who has been president since 1920. Dr. Scott joined the university in 1900 as instructor in psychology and pedagogy and later became professor of psychology and director of the Psychological Laboratory.

DR. ROBERT A. MOORE, assistant professor of pathology at the Cornell University Medical College, has been appointed Edward Mallinckrodt professor of pathology and head of the department at Washington

University, St. Louis. Dr. D. K. Rose, associate professor of genito-urinary surgery, has been made full professor and head of that division in the department of surgery, and Dr. Felix Deutsch, a member of the faculty of the University of Vienna from 1919 to 1935, has been made associate professor of psychosomatic medicine.

DR. HAROLD C. UREY, professor of chemistry at Columbia University, has been appointed executive officer of the department of chemistry for a term of three years beginning on July 1. He will succeed Dr. Henry C. Sherman, Mitchill professor of chemistry, who has been head of the department for the last twenty years. Dr. Sherman will devote his time to research and teaching. Dr. J. Enrique Zanetti, professor of chemistry, has been named to the newly established position of director of laboratories.

RETIREMENTS from the faculty of the Johns Hopkins University have been announced as follows: Dr. Dean DeWitt Lewis, professor of surgery and surgeon in chief, the Johns Hopkins Hospital; Dr. Edward Bennett Mathews, since 1917 professor of mineralogy and petrography, and Dr. Thomas S. Cullen, since 1917 professor of gynecology. Each of them will receive the title of professor emeritus.

PROFESSOR WERNER HEISENBERG, of the University of Leipzig, will be visiting professor at Purdue University from July 1 to July 22 during the summer school session. He will lecture on problems of nuclear physics and cosmic rays.

DR. ROBERT HEGNER, professor of protozoology at the Johns Hopkins University, has accepted an invitation from the Department of Public Health of Mexico to help to organize a new Research Institute of Hygiene and Tropical Diseases, for which a building has been erected in Mexico City. He will sail on April 20 and return late in September. Dr. Redginal Hewitt will accompany him, and later in the season Marion Brooke will spend several months working at the institute under Dr. Hegner's direction.

DR. JOHN T. KING, associate in medicine of the School of Medicine of the Johns Hopkins University, was recently appointed physician-in-chief of the Baltimore city hospitals, filling the vacancy caused by the death of Dr. Thomas R. Boggs.

DR. P. N. ANNAND has been appointed assistant chief of the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture, effective on April 1. Since September, 1937, he has been a special assistant to the chief of the bureau on matters relating to research. He will continue to give special attention to the integration and planning of the research work.

DR. GEORGE S. STEVENSON, for twelve years director of the Division of Community Clinics of the National Committee for Mental Hygiene, has been appointed medical director, succeeding Dr. Clarence M. Hincks, who has asked to be relieved of the work, except as part-time field consultant, in order that he may give more time to the work of the National Committee for Mental Hygiene of Canada, of which he is the general director and founder. H. Edmund Bullis, who has served as executive officer of the National Committee and as assistant to Dr. Hincks, continues on the staff as part-time business manager.

ROBERT E. ADAMS, a recent graduate of the University of Wisconsin, and W. G. N. Heer, graduate in metallurgy of the University of Alabama, who was previously associated with the Tennessee Coal, Iron and Railroad Company, have been appointed members of the technical staff of the Battelle Memorial Institute, Columbus, Ohio. Both have been assigned to the process metallurgy division.

PROFESSOR JOHN S. DODDS, chairman of the American Engineering Council Committee on Surveys and Maps, has been appointed a member of the Advisory Council of the Federal Board of Surveys and Maps.

Nature states that J. E. Montgomrey has been appointed secretary of the British Institution of Mechanical Engineers in succession to Brigadier-General Magnus Mowat, who has retired on account of ill health. Mr. Montgomrey has been assistant secretary of the institution since 1920.

THE British Minister of Health has appointed a number of consultant advisers on the organization of hospitals in England and Wales in war-time. These advisers, who were nominated by the presidents of the Royal Colleges of Physicians and Surgeons, are Dr. Gordon Holmes, neurology; Dr. Bernard Hart, psychiatry; Dr. Gwynne Williams, orthopedic surgery; Sir Cuthbert Wallace, general surgery; Sir Harold Gillies, facial and jaw injuries; Dr. A. Tudor Edwards, chest wounds; Professor Hugh Cairns, head injuries; Professor F. R. Fraser, general medicine; Dr. W. M. Mollison, ear, nose and throat; Dr. C. B. Goulden, ophthalmology, and Dr. A. E. Barclay, radiology.

THE Medical Research Council of Ireland has awarded a grant for one year's training in methods of research on hormones to Dr. T. E. T. Bradshaw and a whole-time grant for one year to carry out serological research in the department of bacteriology, Trinity College, Dublin, to Professor Hans Sachs. Grants-in-aid of research expenses have also been made to Professor T. W. F. Dillon, Professor J. F. Donegan and Dr. Patrick FitzGerald. The grants made to Dr. J. C. Flood, Dr. R. A. Q. O'Meara and Dr. J. C. Shee have been renewed.

PROFESSOR BERGEN DAVIS and Professor Daniel D.

Jackson, of the department of physics of Columbia University, have leave of absence for the present semester.

DR. JONAS BORAK, of Vienna, the radiologist, who has been invited to give a number of lectures at New York University, arrived in New York on April 6.

THE Acoustical Society of America will celebrate the tenth anniversary of the founding of the society on May 15 and 16. A symposium is planned on "The Measurement and Application of Absorption Coefficients." There will also be a program of technical papers, which will include a paper entitled "A Demonstration of Combination Tones," by Sir William Bragg, of the Royal Institution, London.

DR. WILLIAM DEB. MACNIDER, Kenan research professor of pharmacology in the Medical School of the University of North Carolina, delivered a Mayo Foundation lecture at Rochester, Minn., on March 17.

THE eighth annual series of addresses under the auspices of the Benjamin Knox Rachford Lectureship will be given at the Children's Hospital Research Foundation, Cincinnati, Ohio, by Dr. Ernest W. Goodpasture, professor of pathology at Vanderbilt University. The subjects of the lectures will be: "Experimental Virus Infections of the Chick Embryo" and "Experimental Bacterial Infections of the Chick Embryo."

DR. FREDERICK F. RUSSELL, professor of preventive medicine and epidemiology, emeritus, of the Harvard Medical School, will deliver the annual Cutter lecture in preventive medicine on April 17. His subject will be "The History of Yellow Fever as an Illustration of Methods of Study and Control of Virus Diseases."

DR. C. H. DANFORTH, professor of anatomy at Stanford University, will deliver the seventh Harvey Society lecture of the current series at the New York Academy of Medicine on April 20. He will speak on "Genic and Hormonal Factors in Some Biological Processes."

DR. RENÉ LERICHE, professor of chemical surgery at the University of Strasbourg, delivered the Lister Memorial Lecture before the Royal College of Surgeons of England on April 5. The lecture was entitled "The Listerian Idea in the Year 1939."

A NEW series of short courses in science is announced by the American Institute, New York City. Dr. M. L. Crossley, director of research of the Calco Chemical Company, will lecture on "Sulphanilimide and its Compounds." His lectures were announced for April 11, 18 and 25. The dates of lectures by Dr. Oscar Riddle, of the Station for Experimental Evolution at Cold Spring Harbor, Long Island, on "The Endocrine Glands" are April 13, 20 and 27. The lectures will be given at 7:30 P.M. at the meeting rooms of the institute, 60 East 42d Street, New York City.

THE Royal College of Surgeons, London, has appointed Sir James Walton Bradshaw lecturer and Sir Walter Langdon-Brown Vicary lecturer for the coming year.

THE forty-fourth annual meeting of the Michigan Academy of Science, Arts and Letters was held on March 9, 10 and 11. Included in the program were addresses by Professor Arthur E. R. Boak, president of the academy, and by Dr. George H. Whipple, dean of the School of Medicine and Dentistry of the University of Rochester. Professor Boak spoke on "The Rôle of Taxation in the Decline of the Roman Empire," and Dean Whipple on "Anemia and the Building of Hemoglobin in the Body." Two hundred and ninety-four special papers were included in the program.

THE Dutch Congress of Natural Science and Medicine was held at Nymwegen, under the presidency of Professor G. Holst, from April 11 to 13.

AN extensive program is being developed for the 1939 World Engineering Congress of the Society of Automotive Engineers. Some sixty technical papers by well-known authorities are given on the preliminary program; over one third of the speakers are Europeans. The congress opens on May 22 in New York for a five-day session, will be in Indianapolis from May 29 to 30, in Detroit from May 31 to June 2 and closes with a three-day session in San Francisco, ending on June 8. Advanced engineering design problems of aircraft, automobile, trucks, buses, railcars, the rôle of tractors in our national economy, operating problems of fleet owners and reports on fuels and lubricants developments will be covered by the congress.

THE University of Pavia arranged a celebration in honor of the eighteenth-century physiologist, biologist and vulcanologist, Spallanzani (1729–1799), which was held in Pavia from April 11 to 14. According to *Nature*, a monument to Spallanzani was unveiled and a program of scientific addresses, mainly on modern genetical problems and the physiology of reproduction, was presented by delegates invited from various countries, including from Great Britain Professor R. Ruggles Gates, Professor F. A. E. Crew and Dr. C. F. Pantin. Meetings of the societies for experimental biology, botany, geology and veterinary medicine are also being held at the university, and a visit will be paid to the Spallanzani Museum at Reggio Emilio.

Museum News states that a survey of the exhibits

at the world's fairs at New York and San Francisco will be made by internes in training at the Buffalo Museum of Science under Carlos E. Cummings, director, in cooperation with Robert P. Shaw, director of the New York Museum of Science and Industry. The internes will make an analysis of each exhibit, covering such items as the use of light and color, sound effects, labels, leaflets and folders, attendants and visitor participation and flow. An endeavor will be made also to list exhibits that might be suitable for museum use after the fairs. The Rockefeller Foundation has made a grant for preparing a report. The American Museum of Health, New York, has received a grant from the Carnegie Corporation of New York for a study of the reaction of visitors to the museum's medical and public health exhibit at the New York fair. The study will be directed by Dr. Mayhew Derryberry, of the U. S. Public Health Service.

DISCUSSION

DISEASE, DAMAGE AND POLLINATION TYPES IN "GRAINS"

AMERICAN students of plant diseases for over half a century have been more concerned with the organisms causing disease, especially fungi, than with the host plants. No doubt the present interest in plant breeding will tend to readjust the balance. But even to-day interest in virus diseases centers rather on the nature of the viruses than on their effects. In particular, any attempt to generalize as to the disease relations of groups of plants has been almost wholly lacking from our literature. Hartley's[1] discussion of the disease hazards incident to planting clonal varieties of trees is a conspicuous exception. He notes that "The expectation that genetic uniformity will favor the building up of specialized strains of parasites is supported by practical experience with such clonal cultures as Lombardy poplar avenues, rubber plantations, fruit trees, roses, potatoes, bananas, sugar cane and the creeping-bent golf-green grasses." The present paper is an attempt to examine some of the available evidence in order to determine whether such a relation is observable among major crop plants.

That numerous biological strains of many parasitic fungi exist in nature and that they vary continually through crossing and otherwise has been abundantly demonstrated in recent literature. Some of our crop plants, on the other hand, because of the method used in propagation or their own floral characteristics, have very much less natural opportunity for variation and adaptation than others. It seems probable that in their long-continued mutual association, parasites might well obtain a relatively greater advantage over those host plants which themselves had the least capacity for variation and adjustment. This might express itself in greater disease losses over a period of years or, in the case of parasites particularly favored by special environmental conditions, it might express itself in epidemics in the relatively weaker groups of host plants.

As to the capacity of the host to vary and adjust itself, vegetatively propagated plants would be less efficient than those produced from seed. Among plants grown from seed there would be a gradation in this respect from plants largely self-pollinated, to plants with perfect flowers which are usually cross-pollinated, then monoecious and finally dioecious or heterostylous plants. Of course, no such complete series exists among comparable crop plants, but those commercially classed as "grains" offer some interesting contrasts.

In an attempt to evaluate disease losses in the United States as a whole, one naturally turns first to the estimates of diseases losses compiled by the Plant Disease Survey. These have, however, been systematically collected for only twenty years and suffer, to some extent, from the lack of regular reports from many states. In fact, there are no subjects on which present-day plant pathologists are more reluctant to express an opinion than the extent of crop losses from disease and the economic importance of plant diseases. These are obviously not the same thing. Economic importance, while difficult to measure, must be in some way a function of the value of the crop concerned, the loss caused by disease and the fluctuations in loss. This last is a very important consideration. Other things being equal, even the average losses over a period of years, that disease is the most important which fluctuates most. Secretary Wallace has said, "Fluctuations in yields cause as much embarrassment as unbalanced acreage."[2]

In searching for some means of measuring the relative importance of diseases of economic plants, it dawned upon me that volume of publication must, in some degree at least and for the more important crops, express the opinion of plant pathologists and others interested as to the importance of diseases.

I have accordingly tabulated the total pages regarding the diseases of various important crops in the publications of the U. S. Department of Agriculture up to January, 1925, of the Experiment Stations up to December 1, 1927, and in *Phytopathology* up to January, 1927. This covers, for the experiment stations, a period of 40 years and, in the case of the

[1] Carl Hartley, *Phytopathology*, 29: 9, 1939.

[2] *New Republic*, December 2, 1936.

Federal Government, goes back even before the Department of Agriculture was organized and includes some publications of the Commissioner of Patents. My reason for stopping at a point over a decade ago is that these are the dates of the excellent bibliographies compiled by Miss Jessie Allen, librarian of the Bureau of Plant Industry. In the introduction to one of these, Miss Allen states that, "Some appraisement has been made for subjects upon which there are many contributions, the brief and less important ones being omitted. For subjects on which there are few publications all have been included." Thus any error in the figures is in increasing their size for the less important crops or diseases.

Obviously such a means of measuring the importance of plant diseases can have no validity in the case of many small and highly specialized crops where the publications of a small group of enthusiastic workers or even one investigator—or for that matter a single paper—easily assume undue importancce. Nor could we expect to compare too closely, succulent vegetables with grains. But it may be possible to obtain a measure of the apparent relative economic importance of diseases in the culture of crops which have a not too widely different value per acre, are marketed in somewhat the same way, and produced by more or less comparable groups.

Such a unit is apparently found in the crops classed together as "grain crops" for statistical purposes in the publications of the U. S. Department of Agriculture. For such crops this means of measurement must have real significance, unless there has been something radically wrong with the administration of plant disease work in this country over a period of half a century. Most of this work has been tax-supported and the obligation to see that most of the money was spent where most needed must have been generally recognized. Indeed, it would probably have been enforced by popular pressure.

If such figures are to be used as a means of evaluating the relative importance of diseases in different crops, some adjustment must be made for the value of the crop; the most obvious method seems to be to divide the number of pages published by the value of the crop concerned in millions of dollars. This has been done, using the average value of the crop for the ten-year period 1910–1919 as a basis of computation. Several other periods were tried with no difference in the order of the various crops. Some of the results of this summary are given in Table 1.

For comparison with these crops, it may be noted that the disease indices computed on the same basis for grapes and the important tree fruits—all vegetatively propagated—are over 30 and that for potatoes over 20.

TABLE 1

RELATIVE ECONOMIC IMPORTANCE OF DISEASE IN VARIOUS "GRAINS" AS INDICATED BY VOLUME OF PUBLICATION IN U. S. A.

	Total pages	Disease index (corrected by value of crop)
Flax	426	14.2
Rice	205	4.9
Barley	526	3.5
Wheat	3526	3.4
Sorghum	305	2.3
Oats	1178	1.8
Rye	94	1.5
Corn	1941	0.8
Buckwheat	0	0

Whatever may be one's opinion of the validity of this method of appraising the importance of diseases in the culture of a crop, there are probably few who will take exception to the fruits being placed far above the grains in this respect or to the order of most of the "grain" crops in the table.

In this it is at least worthy of comment that the highest six are largely self-pollinated under natural conditions, rye and corn chiefly cross-pollinated, and buckwheat heterostylous and thus always cross-pollinated.

There can be no point in emphasizing too much the fact that at least up to 1927 no single page had been devoted to diseases of buckwheat in the literature reviewed. Indeed, the only reference to the subject found so far is the statement in Robbins and Ramaley's text,[3] "It is singularly free from insect pests and fungous diseases." To be sure, buckwheat is not a major crop, nor on the other hand is it negligible. Its average farm value per year for the period 1910 to 1919 was over 16 million dollars, and in 1920 the farm value of the crop in New York State was over 6 million. Serious epidemics of disease in crops valued at 6 millions have not gone unnoticed in New York State during the past 25 years.

Any one who is unwilling to accept the significance of a correlation between the striking freedom from disease and the fact that the plant can reproduce only by crossing (a condition comparable to that in all the higher animals) should at least advance some other hypothesis.

NEIL E. STEVENS

UNIVERSITY OF ILLINOIS

ARTIFACTS IN CANADIAN RIVER TERRACES

ARCHEOLOGY frequently yields finds tantalizing in their incompleteness and implications, which do little more than point the way for future work. It is in this class that we must place the few rough artifacts found this past summer in the terraces of the North Saskatchewan and Peace rivers, in Alberta.

[3] "Plants Useful to Man," p. 184.

Along the North Saskatchewan, about three miles southwest, or up river from Edmonton, are the gravel pits from which are taken much of the road and construction gravel used in the city. Reports of the occasional occurrence of bones in the gravels prompted an examination which resulted in the recovery of eight more or less fragmentary and waterworn unfossilized horse bones of a large and a small species, a section of unidentified antler and several artifacts. With one exception the bones had been removed by the workmen, who report that they are found haphazardly scattered at any depth in the gravel, apparently none of them articulated.

The artifacts found *in situ* in the pit walls consist of a large quartzite core, two large quartzite flakes, one seemingly retouched into a rough sidescraper, and pieces of petrified wood and chalcedony. The core lay near the bottom of a gravel-streaked clay pocket in the terrace surface, the other pieces in the upper portion of the gravel. Professor P. S. Warren, of the department of geology, University of Edmonton, kindly inspected them before they were moved and agreed that they were not intrusive; that the overlying material indicated that they had been buried by the action of the river while it was still at the level of this terrace. Apparently, the natives had sought stones suitable for tools and weapons at periods of low water, the scrap material left behind being covered by subsequent flooding. A search of the loose, disturbed gravel produced two roughly flaked waterworn quartzite cobbles and several questionable pieces.

In his study of the glaciation of this area Professor Warren has prospected the source of the terrace gravel, an exposed bank of boulder clay capped with glacial lake silt, for bones or fossils. He has seen nothing to indicate that the bones commonly found in the gravel were derived from that source, which may mean that they are remains of animals dying in the valley at the time the terrace was forming.

At present we have no means or data for computing the age as indicated by the change in river level, a drop of about eighty-five feet (measurement by aneroid).

A similar situation apparently exists along the Peace River. In the course of railroad and highway construction a large pit has been excavated in an old terrace, one hundred feet above present water level, at the west end of the bridge crossing from the town of Peace River. Unfortunately, the three or four roughly flaked waterworn quartzite cobbles which can be classed as artifacts were all found in loose or disturbed gravel; their association with the formation depending partly on their condition. The one bone secured, a metatarsal, is from an animal comparable in size and form to *Cervus canadensis,* and was down about eighteen feet in the gravel.

Although these things tell us nothing of the former inhabitants of Alberta, they do help to define the ground where we may ultimately find their history.

Junius Bird
American Museum of Natural History

A NEW OUTLINE MAP OF NORTH AMERICA FOR PHYTOGEOGRAPHERS

During the preparation of a series of distribution maps showing the geographical ranges in North America of several hundred species of bryophytes, some of nearly all the available outline maps issued by various publishers were tried out, one after another. Each one of them was found to be unsuitable in some way, at least for my purposes. The map which was most nearly satisfactory, and which was found to reproduce very well, was one lithoprinted in Ann Arbor as No. 21B in "The Geographical Institute's Series of Maps and Graphs," under the sponsorship of Professor Robert B. Hall, of the department of geography, University of Michigan.

As this map went out of print just as it was becoming most useful to me, Professor Hall very kindly agreed to prepare a map specifically designed to meet my needs and those of phytogeographers in general. For help and advice in the selection of what such a map should show, I am very grateful to many botanists, especially H. H. Bartlett, E. T. Wherry and F. J. Hermann; also to G. M. Stanley, of the department of geology, University of Michigan.

The new map has just appeared as "North America–205C" in "Hall's Series of Maps" published by John Wiley and Sons. It is printed from copper plates on $8\frac{1}{2} \times 11$ inch stock and presents a combination of features of various kinds not found on other outline maps. For instance, the Aleutian Islands and the Lesser Antilles both appear, as well as the entire Arctic American Archipelago and all Greenland (Bonne's projection). With the exception of the Arctic Circle and the Tropic of Cancer, which are indicated separately, latitude and longitude are indicated at ten-degree intervals. The most important drainage systems are shown, yet not enough in detail to clog when the map is reduced one half to two thirds in publication. Further features, very important in the light they shed on geographic distribution of plants, are (1) the Fall Line (after Loomis[1]), (2) the total extent of Pleistocene glaciation (after Antevs[2] and Daly[3]) and (3) the maximum extent of the Wisconsin stage of the Pleistocene in eastern North America (after Leverett and Taylor,[4] Leverett[5] and Antevs[2]).

[1] F. B. Loomis, "Physiography of the United States," viii + 350. New York, 1937.
[2] E. Antevs, *Bull. Geol. Soc. Amer.*, 40: 631–720, 1929.
[3] R. A. Daly, "The Changing World of the Ice Age," xix + 271. New Haven, 1934.
[4] F. Leverett and F. B. Taylor, U. S. Geol. Surv. Monogr. 53. Pp. 1–529. Washington, 1915.
[5] F. Leverett, *U. S. Geol. Surv. Prof. Paper* 154-A: 19, Fig. 5, 1929.

In its preparation, the new map was designed not only for manuscript notes, but for reduction to at least half-size in publication, and full permission is generously given by Dr. Hall and the publishers for the reproduction of this map to illustrate geographical distribution of plants (or animals) in scientific publications.

WILLIAM CAMPBELL STEERE
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MECHANICS OF INDEXING

THE "Easier Method for Making an Index" (SCIENCE, March 10) is extremely rapid and simple in comparison with the method described in the issue of January 20, but it involves perforated sheets, which are not always available; tearing off the slips takes time, and perforated edges do not facilitate filing. In this department we have used a slightly different method. Typewriter paper is marked off in rectangles, ten of which may be used on a sheet if entries are brief. After writing a few sheets, the typist becomes familiar with the spacing, and guide lines are unnecessary. When the typing is completed, all the sheets, whether 50 or 500, are sheared (in one operation) with a paper cutter to the dimensions of the original guide lines. This procedure was used here in 1936 in indexing a bibliography ("Non-Metallic Inclusions . . ." by McCombs and Schrero) with 2,136 items, and three or four times that number of entries in the index.

For an index which is to be printed, rather heavy paper should be used. A compositor expects his copy on sheets, and sometimes does not welcome slips. We use a rack or "gadget" which holds several hundred slips directly in front of the compositor. If the paper is not too flimsy, this works very well. Before going to the printer all slips, including cross references, should, of course, be consecutively numbered with a numbering stamp. After all, this mechanical work of recording and filing entries is only a very minor part of making a good index.

E. H. MCCLELLAND
CARNEGIE LIBRARY OF PITTSBURGH

SCIENTIFIC BOOKS

ASIATIC BOTANY

A Bibliography of Eastern Asiatic Botany. By ELMER D. MERRILL and EGBERT H. WALKER. Sponsored by the Smithsonian Institution, Arnold Arboretum of Harvard University, New York Botanical Garden and Harvard-Yenching Institute. Quarto. Pp. xlii + 719 (double column), 2 maps. Jamaica Plain, Mass.: Arnold Arboretum, 1938. Price, $12.50.

ALTHOUGH most large bibliographies defy "reviewing" in the ordinary sense, such an ambitious undertaking as that cited above should certainly be brought to the attention of all botanists and scientific libraries. It is the type of work whose every page betrays many hours of careful and persistent searching, note-taking and checking, not to mention the arduous task of proofreading and rechecking the numberless details for which none but the authors can be responsible.

Work on this bibliography of eastern Asiatic botany covered a period of ten years, beginning at the Smithsonian Institution in 1928 when Mr. Walker, engaged in identifying material at the United States National Herbarium, found it necessary to familiarize himself with the literature of the plants of China. The project grew in scope until the area finally covered by the bibliography comprises China, Japan, Formosa, Korea, Manchuria, Mongolia, Tibet and eastern and southern Siberia. In addition, the major published papers pertaining to adjacent areas, such as the Philippines, Indo-China, Siam, Burma, India and central and northern Asia, are included, "because of their importance in the study of the plants of eastern Asia, and because through them the subsidiary literature on these areas can be reached."

The bibliography proper (occupying 550 double-column pages and printed in a compact but very readable style of type) contains more than 21,000 titles listed by author. The majority of the entries are briefly annotated, and there are hundreds of cross-references.

Following the main section is an appendix consisting of (1) a list of older Oriental works, many of which have not been heretofore mentioned in botanical literature; (2) a reference list and index of Oriental serials, with titles given in English, in Chinese or Japanese characters and in transliteration; (3) reference lists of Oriental authors (also with the Chinese or Japanese characters); (4) a subject index (in three parts—general, regional and systematic); (5) a family index of generic names of vascular cryptogams and seed plants; and (6) an index of the principal geographic names used in the subject index. In addition, the bibliography is prefaced by a reference list of more than 1,200 serial publications that are cited, with their complete and abbreviated titles. These various indices and appendices render the work extremely usable, though the labor of their compilation must have been great. Fortunately, both Dr. Merrill and Mr. Walker have worked in the Orient and were familiar with many problems, such as the need for careful translation and uniform transliteration of Chinese, Japanese and Rus-

sian characters, that are uncommon to most bibliographic enterprises.

Bibliographies as thorough and as well appointed as this one are definite milestones in the progress of research, in no matter what field. With the bewildering increment of literature in all branches of science, the great need for bibliographies is scarcely to be disputed. The most serious problem these days is to find funds for bibliographic publication after the necessary work of compilation has been done. In the present case the assiduity of the compilers and the interest and generosity of the sponsors, including one anonymous contributor, are especially gratifying. Botanists and plant scientists of at least three continents are the beneficiaries.

PAUL H. OEHSER

U. S. NATIONAL MUSEUM

GRIGORE ANTIPA

Grigore Antipa. Hommage à son oeuvre. 10 décembre, 1867—10 décembre, 1937. Bucharest, Imprimeria Natzională, 1938. (Published under the auspices of the Roumanian Society of Sciences.) Pp. 727; numerous plates and illustrations.

THIS noble volume, admirably printed and illustrated, is a tribute to one of the wisest and kindliest of modern biologists—Director Antipa, of the Bucharest Natural History Museum, Haeckel's assistant for many years at Jena, ex-minister of agriculture and world-renowned leader in fresh-water fishery development. Tendered to him on his seventieth birthday by pupils and friends, it contains a bibliography of his writings, accounts of his work as scientist, sociologist, economist and museum director; but its main bulk consists of valuable scientific papers in French, German, Italian and English (very few in Roumanian). These touch almost every phase of scientific interest, from the weathering rate of sedimentary rocks in Switzerland and the Pliocene fauna of Roumania, to sardine fisheries on the Chilian coast and an article by our own Henry Baldwin Ward on "Environmental Stimuli and Salmon Migration"; we even have an article by Netzhammer on Christian martyrs in the Danube basin and one on the development of forensic medicine in Zurich. It is interesting to discover that American "pumpkinseeds" and "bullheads" have made their way into the Danube system; there are specially valuable articles on wheat rust, on vitamin D from Black Sea sharks' livers, on the science of museum display, where Antipa was a pathfinder; but perhaps the most important have to do with pisciculture, in which we recognized Antipa's leadership some years ago by inviting him to investigate and make recommendations for the Mississippi Valley fisheries. Space limits prevent listing of the 52 articles; suffice it to say that this volume should adorn every large biological reference library, and the separate articles should go into the bibliographies. And all of us who have enjoyed the hospitality of Dr. Antipa and his charming wife will rejoice in the worthy quality of this hearty tribute—headed by King Carol himself—to a gentleman and a scholar of the highest rank and a patriot who showed his mettle under the trying conditions of the German occupation of Roumania; and we may take courage for the future of scholarship in the proof it affords of his stimulating influence on the younger generation.

CHARLES UPSON CLARK

CITY COLLEGE, NEW YORK

REPORTS

PURE AND APPLIED SCIENCE RESEARCH AT MELLON INSTITUTE

EIGHTY-SIX industrial fellowships, of which 30 are multiple and 56 individual, have been in operation in Mellon Institute during its fiscal year, March 1, 1938, to March 1, 1939. These investigations have employed 161 fellows and 96 fellowship assistants. During this fiscal year the institute has spent $1,104,405 in carrying on these research programs and its broad studies in pure science, which have been becoming more and more important, according to the twenty-sixth Annual Report of the director, Dr. E. R. Weidlein, to the trustees of the institution.

Of outstanding interest in this report is the account of the investigations on the chemotherapy of pneumonia under way in the institute's department of research in pure chemistry. Several active compounds have been discovered, but none appears to be as generally suitable as hydroxyethylapocupreine. The conclusions of the medical collaborators, Drs. W. W. G. Maclachlan, J. M. Johnston, M. M. Bracken and G. E. Crum, following three years of clinical experience with this drug, demonstrate that the mortality figure in pneumococcic pneumonia in adults during the past year has been greatly reduced in those cases which received hydroxyethylapocupreine. In comparing the mortality figures of the chemically treated cases, which were of course smaller in number, with the serum-treated cases in Pittsburgh, for the same types of pneumonia during the same period of time, almost identical results were observed by these specialists. Hydroxyethylapocupreine, which has shown no evidence of disturbing vision, can be used effectively in all types of pneumonia. Clinical studies of the drug in cities other than Pittsburgh have been arranged for. Experiments

have revealed that, in identical doses within the effective ranges, hydroxyethylapocupreine will protect against pneumococcal septicemia in mice better than sulfanilamide and fully as well as sulfapyridine. These comparative studies are being continued.

In the chemotherapeutic research the institute is supporting at the Western Pennsylvania Hospital in Pittsburgh, Dr. R. R. Mellon and a staff of eight have made extended comparisons of effective dosage and protective values, using large numbers of rats and mice and numerous aromatic sulfur compounds, with pneumococci and streptococci as infecting agents. Investigation of the mode of action of sulfanilamide indicates that the compound likely permits the overproduction of metabolic products by the infecting pneumococcus or streptococcus, which results in an alteration of the growth rate or growth character of the latter. Fundamental research in bacterial variation, using streptococci and tubercle bacilli, has supplied additional evidence that transformations do occur within the present accepted classifications. These findings are being applied both diagnostically and therapeutically as opportunity offers.

The pure research fellowship sustained in the institute by The Buhl Foundation, on the relation of nutrition to various phases of dental caries, has disclosed some new relationships of food to tooth decay and has improved certain necessary techniques. Investigation of the beneficent effects of fluorides in the formation of teeth resistant to caries has not been entirely conclusive. In an attempt to determine what factors in meat confer caries resistance to rat teeth, Dr. G. J. Cox and his coworkers on this fellowship have fed to rats a series of diets varying in protein content. No difference in caries susceptibility was noted from diets ranging by 5 per cent. steps from 10 to 55 per cent. protein. A similar study of varied calcium to phosphorus ratio showed that in the rat the mother during pregnancy and lactation can provide calcium and phosphorus for good teeth over a wide range of ratios of calcium to phosphorus. On the low ratios, however, mothers and young displayed detrimental effects of the diets so far as body weight was concerned. Some preliminary experiments have indicated that suppression of saliva leads to promotion of decay.

Under a Federal Government grant, the fellowship on air pollution control has been cooperating with the department of public health of the city of Pittsburgh in a thorough study of municipal air contamination. There are 100 stations for the collection of precipitated solids and 50 field men who make direct observations of smoking chimneys. There are about 5,000 stacks in the classes regulated by the city's anti-smoke ordinance; and there are 154,000 dwelling units, 119,000 of which burn coal for fuel, and none of them is subject to smoke regulation. Indications are that the dwelling units are the greatest source of air pollution in Pittsburgh during the winter months. At several points the air is being sampled for the purpose of measuring suspended solids. The study of autopsy material is being carried on at the Singer Memorial Laboratory in the effort to determine possible effects of air pollution as noted in Pittsburgh in causing or aggravating respiratory diseases. Answers to 100,000 questionnaires on the effects of smog have been tabulated and will be appraised by medical specialists.

Air Hygiene Foundation of America, a non-profit, science organization with headquarters and a multiple fellowship (Dr. H. B. Meller, senior incumbent) at Mellon Institute, represents a collective effort by 250 industrial employers in behalf of the health of approximately a million workmen. The foundation, in addition to its pure, basic research in industrial hygiene, furnishes company members with practical plant applications to prevent industrial illness and to foster industrial health. During the year the foundation's preventive engineering committee prepared and issued eight bulletins on measures for safeguarding occupational health. Under grants from the foundation scientific investigations progressed at Harvard University, the University of Pennsylvania, The Saranac Laboratory, and Mellon Institute. Two graduate fellowships were established at Harvard to train men in industrial hygiene under Professor Philip Drinker. Research in roentgenography at the University of Pennsylvania seeks to improve x-ray techniques for industrial purposes, as in large-scale medical examinations of groups of workmen. At The Saranac Laboratory Dr. L. U. Gardner, the director, has experimental data to support the thesis that various minerals associated with silica tend to inhibit its action upon the body. The foundation is collaborating in the work of various states and of federal agencies in the field and makes every reasonable effort to fulfill public needs for facts on industrial health subjects.

The report includes descriptions of accomplishments of many industrial fellowships during 1938–39. The multiple fellowship on anthracite showed how completely automatic heat can be readily obtained with Pennsylvania anthracite without the necessity of any attention for weeks at a time. The multiple fellowship on calgonizing found "Calgonite" advantageously useful in cleaning dairy equipment. The multiple fellowship on tire and industrial chains described a number of successful welding electrode coating compositions. Another multiple fellowship, the one on commodity standards, continued productively its studies of major problems in retail merchandising.

The multiple fellowship of the Cotton Research Foundation, an organization of philanthropic business men, expanded its personnel and work in trying to improve the cotton economy of the United States. New

knowledge resulted from studies of hull bran, cottonseed proteins, nutritional properties of cottonseed meal, cotton line, and linters. Through the agency of the institute the foundation established research fellowships at the University of Texas, Texas Technological College, and the University of Tennessee, besides sustaining an investigation at the University of North Carolina and a fellowship on cellulose economics at the University of Pittsburgh.

The multiple fellowship on food varieties reached the full technological development of a line of special foods for the feeding of children beyond the strained foods age. The technical glassware fellowship developed methods and apparatus to evaluate "surface hardness" of glass. The heat insulation fellowship assisted in acquiring technical information on fireproof constructional materials and on all-asbestos insulating air ducts. "Kemite" and "Karcite," laboratory constructional materials, were further studied by another fellowship, with special attention to new raw materials, development of additional properties, and novel applications.

The industrial fellowship on meat merchandising, after three and a half years of research, attained the development to commercial status of a new process making an improvement in the palatability of beef through increase in tenderness and juiciness. The natural gas fellowship studied major problems pertaining to conditions of the distribution and utilization of this fuel. The multiple fellowship on organic synthesis entered its twenty-fifth year of continuous, creative activity. On the multiple fellowship on petroleum refining several new devices were evolved for quick and accurate measurements of physical constants of oil hydrocarbons. The pressing machinery fellowship announced a new, safer and purer type of petroleum naphtha and also improvements in filters and stills for purifying the liquids used in the dry-cleaning industry. The multiple fellowship on protective coatings progressed in investigations of the fundamental structure and properties of organic resin films on metals and other surfaces.

Twenty-two years of age, the multiple fellowship on refractories solved the riddle of "mottled" silica brick. The mineral products fellowship designed and supervised the erection of a large plant for manufacturing "Garspar," a new ceramic raw material, and developed two other silica products, "Garbond" and "Gartex." The multiple fellowship on steel applied the principles of carbon wire technology to the manufacture of stainless steel wire with beneficial results and devoted much study to problems of manufacturing seamless tubing. Some new uses for sulfur came from the researches of another fellowship.

Seventeen industrial fellowships began work during the year, and four other fellowships have been accepted and will soon start operation. Eight industrial fellowships concluded their investigations during 1938–39. Among the new fellowships the programs on acid recovery (prevention of stream pollution by waste pickle liquors), air filters, gypsum products, plastics in meter construction, criteria of excellence of pearls, and watch lubrication have already advanced by the acquirement of useful results.

During the calendar year 1938, 17 bulletins, 27 research reports and 43 other papers were published. Twenty-four United States patents and 30 foreign patents on fellowship inventions came to issue. The total publications for the 28 years ended December 31, 1938, have been 20 books, 174 bulletins, 803 research reports and 1,225 miscellaneous articles; 714 United States patents were granted during the same period.

W. A. HAMOR

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SPECIAL ARTICLES

DISINTEGRATION OF TOBACCO MOSAIC VIRUS IN UREA SOLUTIONS

CHANGES are known to occur in the structure of proteins when they are dissolved in concentrated solutions of urea. In the case of egg albumin, the alteration is quite marked,[1] whereas in the case of hemoglobin and of pepsin, the degree of the change is much less, for, although hemoglobin is split into half-molecules,[2] there appears to be no change in the special properties of these proteins. Recently it was reported[3] that solution of tobacco mosaic virus in 6 M urea and 0.1 M phosphate buffer caused a 100-fold increase in the diffusion constant of the material with no change in the virus activity. Since this would indicate a decrease in molecular weight from one of the order of several millions to one of about 100,000, and, since in many previous attempts[4] it had not proved possible to demonstrate the existence of low molecular weight material possessing virus activity, it seemed desirable to reinvestigate the effect of concentrated urea solution on tobacco mosaic virus.

[1] F. G. Hopkins, *Nature*, 126: 328, 383, 1930; M. L. Anson and A. E. Mirsky, *Jour. Gen. Physiol.*, 13: 121, 1929; H. Wu and E. F. Yang, *Chinese Jour. Physiol.*, 5: 301, 1931.

[2] N. F. Burk and D. M. Greenberg, *Jour. Biol. Chem.*, 87: 197, 1930; J. Steinhardt, *Jour. Biol. Chem.*, 123: 543, 1938.

[3] V. L. Frampton and A. M. Saum, SCIENCE, 89: 84, 1939.

[4] W. M. Stanley, in *Handbuch der Virusforschung*, Springer, Wien, 1938.

A solution containing 10 milligrams of tobacco mosaic virus per cubic centimeter in 6 M urea and 0.1 M phosphate buffer at pH 7 was prepared at room temperature and determinations of virus activity, stream double refraction, turbidity and the amount of protein insoluble in 0.1 M phosphate buffer were made after different periods of time. Since it is not possible to measure virus activity in the presence of high concentrations of urea, the solutions used for activity determinations were diluted with 9 parts of distilled water, and portions of these with 9 or more parts of 0.1 M phosphate buffer at pH 7. These solutions were then compared with controls containing the same small amount of urea, 0.1 M phosphate buffer, and appropriate amounts of virus, by means of the half-leaf method using 30 or more *Nicotiana glutinosa* L. leaves in each test. The stream double refraction measurements were made directly on the urea-virus solution by the method previously described.[5] The turbidity measurements were made with a photoelectric colorimeter by comparing a constant depth of the virus-urea solution with a variable depth of a copper sulfate standard. It may be seen from Table I that solution in 6 M urea and 0.1 M phosphate buffer at pH 7 immediately caused a reduction in virus activity and that after 1, 8 and 96 hours only about 25, 1 and 0.1 per cent., respectively, of the original activity remained. It may be seen from Fig. 1 that this reduction in activity was accompanied by decreases in turbidity, in the amount of protein remaining soluble in dilute buffer, and in stream double refraction. Mehl[6] has also noted the decrease in stream double refraction in urea solutions.

TABLE I

Hours in urea	Virus in urea: Gm. protein/cc. in inoculum	Virus in urea: No. of lesions/ half-leaf	Control: No. of lesions/ half-leaf	Control: Gm. protein/cc. in inoculum	Estimate of per cent. reduction in activity
< 0.1	10^{-5}	42.7	38.3	5×10^{-6}	
	10^{-4}	103.9	46.2	10^{-5}	ca 50
1	10^{-4}	60.9	41.2	10^{-5}	ca 75
4	10^{-4}	37.5	10.5	10^{-6}	> 90
8	10^{-4}	12.4	7.8	10^{-6}	ca 99
30	10^{-4}	2.9	0.9	10^{-7}	> 99
96	10^{-4}	0.2	1.9	10^{-7}	> 99.9

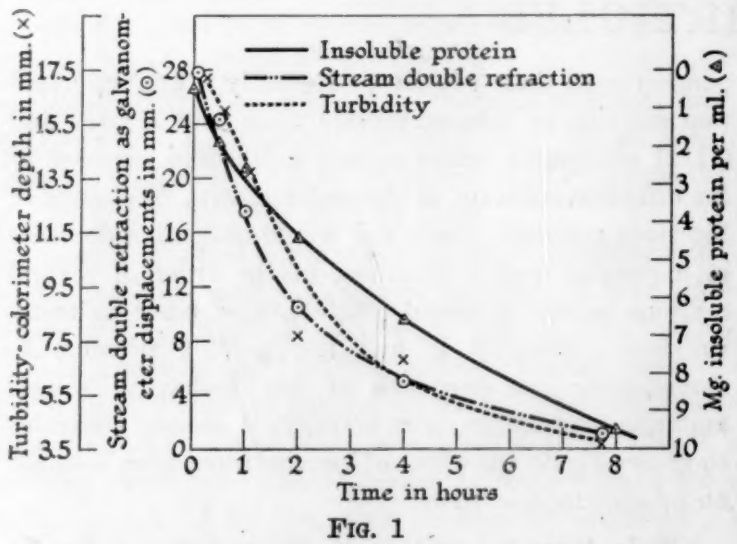

FIG. 1

The fact that the protein insoluble in dilute buffer was found to be free of nucleic acid indicates that the changes described above are due to the degradation of virus nucleoprotein. This disintegration was followed by means of osmotic pressure determinations which indicated an average molecular weight of about 100,000 after 5 days and about 40,000 after 4 weeks. The formation of low molecular weight material was also demonstrated by subjecting virus-urea solutions to high-speed centrifugation. In every one of over 50 experiments the low molecular weight, non-sedimentable material remaining in the supernatant liquids was inactive, and any residual infectivity was always associated with high molecular weight material which sedimented at a rate comparable to that with which ordinary virus sediments. The specific activity of remaining high molecular weight material, whether consisting of traces or of the major portion of the protein, was found to be from 10 to 50 per cent. that of ordinary virus protein. Following extensive disintegration, practically all the protein was found in the supernatant liquid and only traces in the sediment. Dilution of the supernatant liquids containing the low molecular weight protein with distilled water or with 0.1 M phosphate buffer or removal of the urea by dialysis failed to yield solutions possessing virus activity. Therefore, the disintegration does not appear to be readily reversible. The solution of virus in concentrated urea was accompanied by the appearance of a positive nitroprusside reaction, indicative of the formation of free sulfhydryl groups. These were estimated with the porphyrindin dye according to the method described by Greenstein.[7] The titration of a sample prepared by the addition of 2 grams of urea to 2 cubic centimeters of a solution containing 73 milligrams of virus at pH 8 corresponded to 0.70 per cent. cysteine. When 3.2 grams of guanidine hydrochloride were added to 2 cubic centimeters of the virus solution and the hydrogen ion concentration adjusted to pH 7, the titration after 1 hour corresponded to 0.76 per cent. cysteine. These results indicate that all or most of the sulfur[8] in tobacco mosaic virus occurs in the sulfhydryl groups which become free and measurable in concentrated solutions of urea or of guanidine.

The effect of 5 different concentrations each of sodium chloride, potassium phosphate and sodium

[5] M. A. Lauffer and W. M. Stanley, *Jour. Biol. Chem.*, 123: 507, 1938; M. A. Lauffer, *Jour. Phys. Chem.*, 42: 935, 1938.

[6] J. W. Mehl, *Cold Spring Harbor Symposia*, 6: 226, 1938.

[7] J. P. Greenstein, *Jour. Biol. Chem.*, 125: 501, 1938. It is a pleasure to express appreciation to Dr. Greenstein for material and helpful suggestions.

[8] A. F. Ross and W. M. Stanley, *Jour. Am. Chem. Soc.*, 61: 535, 1939.

citrate on the rate of disintegration of virus in 6 M urea at about pH 7.5 was determined by separating the high from the low molecular weight material by high-speed centrifugation after different periods of time. Disintegration proceeded most rapidly in 0.1 M phosphate buffer, slightly less rapidly in 0.05 M phosphate, 0.05 M borate and 0.02 and 0.04 M citrate, and less rapidly in 0.01 and 0.3 M phosphate and 0.004 and 0.12 M citrate. The rate was noticeably slower in 0.024, 0.12, 0.24 and 0.71 M sodium chloride and in 0.24 M citrate, and quite slow in 0.6 M phosphate, in 1.4 M sodium chloride and in the absence of electrolytes. The half-life periods of the native protein in the various urea-electrolyte solutions cover the range from less than 2 hours to more than a week. The effect of 4 different hydrogen ion concentrations on the rate of disintegration in 6 M urea and 0.1 M phosphate buffer was also studied. The rate was greatest at pH 8.2, slower at pH 7.4, much slower at pH 6.4 and almost negligible at pH 5.5. The disintegration of virus protein in 6 M urea and 0.1 M phosphate buffer at pH 7 is similar to the urea denaturation of egg albumin[9] in proceeding more rapidly at 0° than at 25° C., but differs from it by proceeding more rapidly at 40° than at 25° C. The rates of reaction during the degradation of about 90 per cent. of the high molecular weight material at 25° or 40° C. in 6 M urea and dilute buffers at about pH 7 may be described fairly satisfactorily by the equation of a first order reaction. However, the amount of high molecular weight active material remaining after about 50 hours, though quite small, may be as much as 10^6 times that predicted by the first order equation.

It may be concluded that tobacco mosaic virus is rapidly disintegrated in 6 M urea and 0.1 M phosphate buffer at pH 7, with appearance of free sulfhydryl groups, into low molecular weight protein components which contain no nucleic acid, exhibit no double refraction of flow, are insoluble in dilute buffers, and, most important, possess no virus activity. The rate of degradation varies widely with the concentration of urea, the concentration of electrolyte, the type of the electrolyte, the hydrogen ion concentration and the temperature. These results, especially the demonstration of the great effect of small changes in pH or in electrolyte concentration on the rate of disintegration, as well as the earlier work on the degradation of virus in solutions of sodium dodecyl sulfate,[10] may provide information concerning the nature of the forces which hold together the large virus molecule. The conclusion of Frampton and Saum[11] that virus activity is associated with the low molecular weight products obtained from tobacco mosaic virus upon solution in concentrated urea has not been confirmed.

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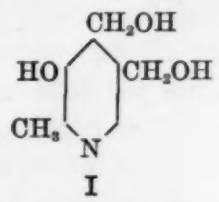
SYNTHETIC VITAMIN B_6

THE isolation of vitamin B_6 was reported by Keresztesy and Stevens,[1, 2] of this laboratory, and also by other workers.[3–6]

The structure of vitamin B_6 was studied at this laboratory, and the evidence which led to the structure is described fully in two papers[7, 8] which are about to appear. The structure of vitamin B_6 was shown to be 2-methyl-3-hydroxy-4,5-di-(hydroxymethyl)-pyridine,



I

I. Kuhn and coworkers[9–11] have announced the results of researches which led to the same structure for the vitamin.

In this laboratory, the complete synthesis of the vitamin B_6 has been accomplished, and we wish to describe the results of the comparison of the synthetic vitamin B_6 hydrochloride with the natural vitamin B_6 hydrochloride.[1]

M.p. 206–208° C., mixed melting point with natural vitamin B_6 hydrochloride, 207° C. Positive ferric chloride test.

Anal. Calc. for $C_8H_{12}O_3NCl$: C, 46.72; H, 5.84; N, 6.81. Found: C, 46.55, 46.64; H, 5.57, 5.69; N, 6.83, 6.75. The biological assay also confirms these findings.

A complete report of this work will be published in the near future.

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[2] Keresztesy and Stevens, *Jour. Amer. Chem. Soc.*, 60: 1267, 1938.
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[4] Kuhn and Wendt, *Ber.*, 71: 780, 1118, 1938.
[5] Ichiba and Michi, *Sc. Papers Inst. Phys. Chem. Research*, 34: 623, 1014, 1938.
[6] Gyorgy, *Jour. Amer. Chem. Soc.*, 60: 983, 1938.
[7] Stiller, Keresztesy and Stevens, *ibid.*, 61, May, 1939.
[8] Harris, Stiller and Folkers, *ibid.*, 61, May, 1939.
[9] Kuhn and Wendt, *Ber.*, 72: 305, 1939.
[10] Kuhn, Andersag, Westphal and Wendt, *ibid.*, 72: 309, 1939.
[11] Kuhn, Wendt and Westphal, *ibid.*, 72: 310, 1939.

[9] F. G. Hopkins, *loc. cit.*
[10] M. Sreenivasaya and N. W. Pirie, *Biochem. Jour.*, 32: 1707, 1938.
[11] *Loc. cit.*

XENIA IN THE CHESTNUT

THE number of species of plants of horticultural importance in which xenia[1] is known to occur is surprisingly small. Since Focke in 1881 used the word xenia with reference to the immediate effect of pollen on the endosperm of *Zea mays* L., this plant has become the classical example of the process. Few references are found in the literature in regard to the type of xenia dealt with in chestnuts (*Castanea* spp.) namely, a measurable effect of the pollen on the embryo of the seed. Blaringhem[2] reported but gave no data on a case of xenia in the chestnut in which time of ripening and size of nut were affected by the kind of pollen used. However, his observations were based upon a small number of hybrid nuts. It should be stated that metaxenia, or the immediate effect of pollen on the maternal or sporophytic tissues of the plant, apparently is of much wider occurrence than xenia due to the complete absorption of the endosperm in most seeds.

In the chestnut the pistillate catkin produces from one to several "burrs," and each of these from one to five flowers, usually three, which if pollinated develop into nuts. Each nut develops from a single ovary. Normally one ovule develops in each ovary to form the seed of the nut, the kernel or fleshy edible portion of the seed being composed of the thickened cotyledons of the embryo. An extensive endosperm is formed soon after fertilization, but the growing embryo quickly absorbs this and "filling" of the nut consists largely of a thickening and increase in size of the cotyledons. Hence the nut of the chestnut is both a fruit and a seed, and the edible portion is the embryo.

The immediate effect of pollen on the seed of the chestnut is expressed through an increase or decrease in the size of the nut, depending upon the kind of pollen used. Since the nut is filled entirely with tissue of the embryo any differential size effect caused by different pollens on the same tree would be a result of the action of the pollen on extent of growth of the embryo. For the past two seasons a tree of the Japanese chestnut, *Castanea crenata* Sieb. and Zucc., has shown this differential effect, producing nuts of distinctly different size as a result of using two kinds of pollen. The tree normally produces large nuts typical of certain varieties of Japanese chestnut. On this tree when pollen from a variety of Chinese chestnut, *C. mollissima* Bl., bearing small nuts is used the mean weight of nuts produced is 18.77 grams. However, where pollen from a variety of Japanese chestnut bearing large nuts is used the mean weight of nuts is increased to 27.12 grams. A difference between the means of eight grams per nut has been observed both seasons, 1937 and 1938, as a result of the two kinds of pollen applied to the stigmas of this tree. With a variance of difference between the means of 1.828 grams this difference is highly significant. Analysis of data from this and other crosses will be presented elsewhere.

During the season of 1938 extensive crosses were made between varieties of three species of chestnut, *C. crenata, C. mollissima* and the European chestnut, *C. sativa* Mill. Many varieties upon which several pollens were used failed to show significant size differences between the nuts harvested. In all three species, however, certain varieties showed a variation in nut size that is clearly indicative of pollen effect on this character. The fact that this effect is not uniformly obtained in all the crosses between varieties or species suggests that nut size in the chestnut may be affected by genetic factors which are inherited from the pollen parent. Since the chestnut is considered to be largely cross-pollinated, the varieties within a species are probably heterozygous to a high degree. On this basis a genetic effect such as herein described could not be interpreted with certainty in all the varieties worked with due to a lack of knowledge of the genetic constitution of the trees. Increase in size of seed when two species are crossed is attributed by certain authors to heterosis or hybrid vigor. This interpretation could be given to instances in the chestnut in which the size of the nut produced by a tree is increased beyond that of either parent by using pollen from a tree bearing large nuts. Since the size of nuts produced by a tree bearing large nuts may be reduced by the use of the proper pollen, the writers consider that variation in nut size in certain chestnut crosses is due to the immediate effect of the pollen on the development of the embryo. It has long been a common observation that certain trees of the American chestnut, *C. dentata* Borkh., produced nuts with split shells, and this may possibly be explained by over-development of the kernel as a result of the action of the pollen of certain varieties.

The results of pollination experiments in the chestnut are at the present time entirely preliminary in nature. The practical implications of the problems involved, however, are many. One of the most significant of these is the fact that the quality of the kernel, as well as the size of nut, may possibly be affected by the variety of pollen used. If this is the case it should be possible to obtain greater uniformity of size and quality in chestnuts by planting the proper combination of varieties for pollination purposes. Chestnuts with split shells are attacked readily by molds and spoil quickly. Since the pollen of certain varieties determines the size of the nuts produced by other varieties, proper pollinators become important in the production of nuts free from split shells.

[1] The generally accepted definition of the term "xenia" is used here, namely, "the immediate effect of pollen on the embryo or endosperm of the seed."

[2] M. L. Blaringhem, *Bull. Soc. Bot. de France*, 66: 354–356, November 14, 1919 (1920).

This type of experimentation provides a rapid method of carrying on certain phases of breeding work with this long-lived group of plants since the results of each year's work are available at the end of the current season. The kernel of other nut-producing species may also be affected by genetic constitution of the pollen, since wide variations in nut size and flavor are noticeable in several species.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

CHLORAZOL FAST PINK BKS AS AN ANTI-COAGULANT

CLOTTING in systems recording blood pressure of animals is a frequent source of annoyance in kymograph experiments. The inexpensive methods of inhibiting clotting are, generally speaking, inffective, while heparin, which is effective, is so expensive that its use is limited.

An effective and inexpensive anti-coagulant would be eminently desirable in any laboratory in which an appreciable amount of work is done which involves the direct recording of blood pressure. We were therefore interested in the properties of an anti-coagulant dye which was suggested by a former member of this department.[1] We have used it with such success, and we have been requested for information concerning its properties, use and preparation from so many sources that it was thought desirable to point out again that such a substance is available, and to record a simple method of purification of the crude product.

In 1932 Huggett and Silman[2] pointed out the anti-coagulant properties of Chlorazol Sky Blue FF (Chicago Blue). They found that the dye acted by inhibiting the clotting effect of calcium and thrombokinase on the fibrogen-prothrombase complex. The dye raised blood pressure slightly and had little or no effect on the gas-carrying power of the blood or the buffering action of the plasma. Later Huggett and Rowe[3] reported that many other azo dyes possessed anti-coagulant properties. Of a group which were examined Chlorazol Fast Pink BKS (Color Index 353) was found the most efficient; even more effective than heparin.

The crude dye was obtained from the General Dyestuff Corporation of New York City (trade name: Fastusol Pink BBA). Inasmuch as the crude dye is toxic it must be separated from salts and other impurities. A simple method of purification was sought. It was found that the dye was precipitated from an aqueous solution by alcohol, and a method of separation from impurities was based on this observation.

The crude dye is dissolved in about 15 parts of water and filtered. To the filtrate an equal volume of 95 per cent. alcohol is added, producing almost complete precipitation of the dye. The mixture is filtered and the precipitate saved. The filtrate should be colored only slightly by unprecipitated dye. The precipitate is washed with 70 per cent. alcohol, dried over steam and ground into a coarse powder.

This method of extraction yields about 20 per cent. of purified dye from the crude commercial product. A so-called commercially pure dye prepared by the General Dyestuff Corporation, which is too toxic as such, yields about 50 per cent. of purified dye by the same method. A dye supplied by the Calco Chemical Company (trade name: Calcomine Fast Pink 2BL) appears to be identical with Fastusol.

The purified dye is used in a 5 per cent. solution. It is relatively non-toxic. As much as 1.0 gm per kg produces only a slight increase in blood pressure, with some slowing of the heart and no effect on respiration. We have found that a single intravenous dose of 100 mg per kg (2.0 cc per kg of the solution) prevents clotting for many hours, and that specimens of blood from animals so treated do not clot in the test-tube for twelve hours or more. For most kymograph experiments 50 or 75 mg per kg suffice, but the 100 mg dose is more certain. These doses stain the animal and its urine, and cause bleeding and oozing from recently ruptured capillaries. It is best, therefore, to complete all operative procedures and to obtain complete hemostasis before the dye is injected. The dye should be injected immediately after cannulation.

A method of using the dye which does not involve intravenous injection has also been found satisfactory. Small amounts of the dye (0.5 cc portions) are introduced at about 30-minute intervals into the pressure system of the recording manometer just above the junction of the cannula and the rubber tubing. A fine needle (No. 25 or No. 26) is used. Some of the dye should go into the blood vessel connected with the cannula.

With the use of the dye other anti-coagulating agents in the pressure system are not necessary. We have discarded saturated sodium sulfate and magnesium sulfate and use only physiological saline in the pressure system.

Several hundred experiments of a variety of types have been conducted in this laboratory without any

[1] Dr. David Robert Climenko.
[2] A. StG. Huggett and H. Silman, *Jour. Physiol.*, 74: Proc. 9P, 1932.
[3] A. StG. Huggett and F. M. Rowe, *ibid.*, 78: Proc. 25P, 1933.

clotting or interference with the course of the experiment. Clotting has been prevented even in experiments in which agents which are known to produce intravascular clotting were used. The dye has proved very valuable in experiments conducted by students.

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EFFECTIVE CONTROL OF CULTURE MITES BY MECHANICAL EXCLUSION

INVESTIGATORS working with fungi *in vitro* are unhappily familiar with the common mycophagous mites, which invade their test-tubes and cause many inconveniences by destroying pure cultures or by contaminating them with other fungi or bacteria. Control of these pests is claimed to have been effected by the use of various volatile chemicals which purport to kill the mites and their eggs. Since plant and other materials harboring these mites are brought almost daily into most mycological laboratories reinfestations readily occur necessitating repeated use of these chemicals, most of which are detrimental to fungous growth and noxious to the person using them. The method of control which was developed and is now being used in this laboratory is based on the positive exclusion of the mites from test-tube cultures by mechanical means. The materials to be used are: (a) 10 per cent. gelatin in water to which has been added 2 per cent. $CuSO_4$ to prevent fungous and bacterial growth, (b) 1 book of L.L.F. cigarette papers and (c) a heavy blotter. About 25 cc of the melted gelatin is poured into a petri dish and allowed to solidify. The cigarette papers are taken from the cover, the small dab of glue that holds the sheets together is cut off, the bundle of sheets is cut in halves, placed in a small preparation dish and sterilized in the dry oven. This treatment with dry heat tends to make the papers separate more readily. The ordinary laboratory procedure now follows: The cotton plug is removed, the tube is seeded and flamed, but instead of replacing the plug the tube is inverted and the hot rim is pressed gently against the surface of the solidified gelatin, thus becoming coated with a thin film of melted gelatin. By touching the gelatin-coated rim to the cigarette papers in the preparation dish the top sheet is neatly picked up and removed and then made to adhere more firmly by pressing it against the resilient surface of the blotter. The tube is now placed upright in a rack with other tubes similarly prepared and so arranged that the corners of the projecting pieces of paper touch. By igniting at a single point, the projecting paper on all the tubes will burn off, leaving neat, circular, paper seals that effectively keep out all faunal and floral contaminants. When sub-cultures are to be made the seal is readily burned off by flaming, and after the transfer is completed the process of sealing is repeated as before. For cultures in liquid media the gelatin is melted and painted on the rim of the tube with a small brush and the paper then placed on top by means of forceps. If so desired, the cotton plug may be retained but should of course be shoved well below the rim of the tube before sealing. We have tested several brands of cigarette papers, many other kinds of paper, several grades of Cellophane and other materials. All Cellophanes and treated papers such as waxed papers greatly depressed growth of the fungi and of all the others tested only the one brand of cigarette papers made a perfect seal and burned without leaving an undesirable black residue. The efficacy of the method was tested by placing together in the same drawer sealed cultures, unsealed, cotton-stoppered cultures and unsealed cultures heavily infested with mites. After a period of months only the sealed cultures remained free of mites. This new method of mite control has the advantage over older methods of being effective, nontoxic to fungi, inexpensive and easily applied. An illustrated account of this and other mite-control methods will be published elsewhere.

The non-technical assistance by employees of the federal Works Progress Administration is acknowledged.

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